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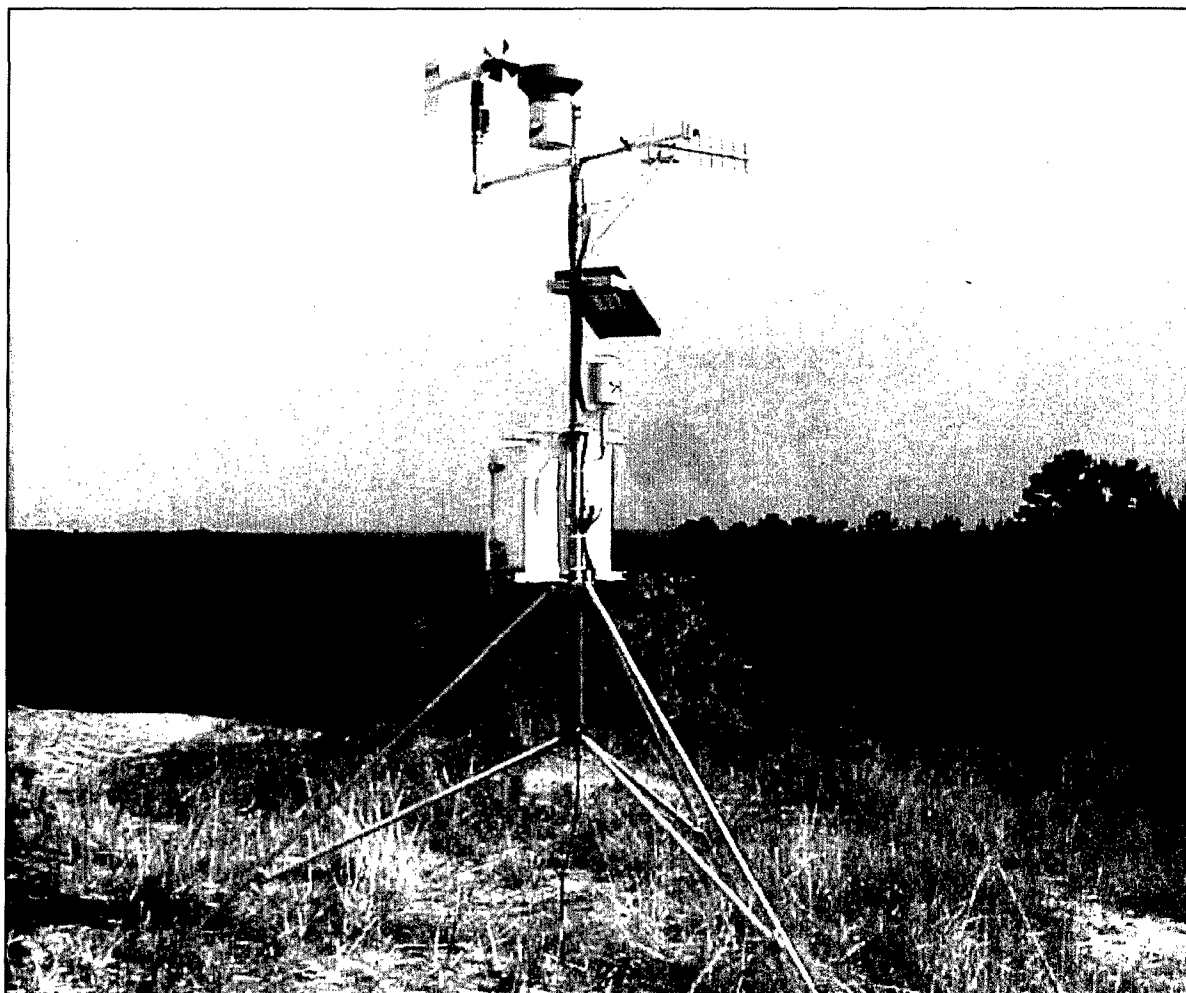
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Strategic Environmental Research and Development Program

Automated Environmental Data Collection at Fort Benning, Georgia, from May 1999 to July 2001

Charles D. Hahn and David L. Leese

April 2002



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Automated Environmental Data Collection at Fort Benning, Georgia, from May 1999 to July 2001

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Final report

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Preface

This report was prepared in support of the Ecosystem Characterization and Monitoring Initiative (ECMI) sponsored by the Strategic Environmental Research and Development Program (SERDP) Ecosystem Management Project (SEMP). The technical monitor was Dr. Robert Holst, SERDP Program Manager.

The work was performed under the direction of the Environmental Laboratory (EL), U.S. Army Engineer Research and Development Center (ERDC), Vicksburg, MS. The EL Principal Investigator was Dr. Margret R. Kress, and co-investigators were Mr. David L. Leese, Information Technology Laboratory, ERDC, and Mr. Charles D. Hahn, EL. This work was conducted under the auspices of Dr. David J. Tazik, Chief, Ecosystem Evaluation and Engineering Division, EL. Project manager for the ECMI was Mr. Harold W. West, EL, and Program Manager for the SEMP was Dr. Harold E. Balbach, Construction Engineering Research Laboratory (CERL), ERDC, Champaign, IL.

Many individuals contributed to the support of this project, including Mr. John Brent, Mr. Pete Swiderek, and Ms. Theresa Davo of Fort Benning, GA, the host site for the SEMP; Mr. Hugh Westbury, the ERDC host site coordinator, and Dr. David L. Price and Mr. Tom Berry, EL. Mr. Hugh Westbury was responsible for the regular station maintenance, calibration of the Hydrolab sondes, and the biweekly manual sampling of the water quality data.

At the time of publication of this report, Director of EL was Dr. Edwin A. Theriot. Dr. James R. Houston was Director of ERDC, and COL John W. Morris III, EN, was Commander and Executive Director.

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1 Introduction

The Strategic Environmental Research and Development Program (SERDP), Ecosystem Management Project (SEMP), Ecosystem Characterization and Monitoring Initiative (ECMI) is a long-term, multiagency program at Fort Benning, GA, to characterize the environment in and around Fort Benning and provide long-term databases documenting the environmental (meteorological, hydrological, biological, and geographical) conditions in the ecosystem. As part of that program, the U.S. Army Engineer Research and Development Center (ERDC), Environmental Laboratory (EL), has been tasked to deploy and maintain meteorological and hydrological instrumentation to document the changing environmental conditions during the study period.

The purpose of this report is to document the instrumentation deployed at Fort Benning, GA, to monitor the meteorological and stream conditions existing on and around the post. Each of the stations (meteorological and stream) is completely automated and self-contained. Most of the stations are equipped with telemetry equipment that allows for daily data retrieval. In addition to the meteorological and water stations, groundwater wells have been installed at four locations to monitor water level and temperature, and regular sampling of stream water quality is being conducted.

2 Data Collection Stations

Meteorological Data

Ten meteorological data collection stations (weather stations) (Figure 1) have been deployed in and around Fort Benning (nine on post and one off post) to monitor and record the climate conditions in the region. The wind speed and direction sensor and rain gauge are visible at the top of the tower along with the solar panel used to maintain the station battery. The evaporation pan and gauge are visible at the base of the tower. The locations of these stations are shown in Table 1 and in Figure 2.

Each of these stations is configured identically with the exception of the station at the Natural Resources Office. (The Natural Resources Office station has additional sensors to document pan evaporation.) The sensors and their specifications are shown in the Table 2.

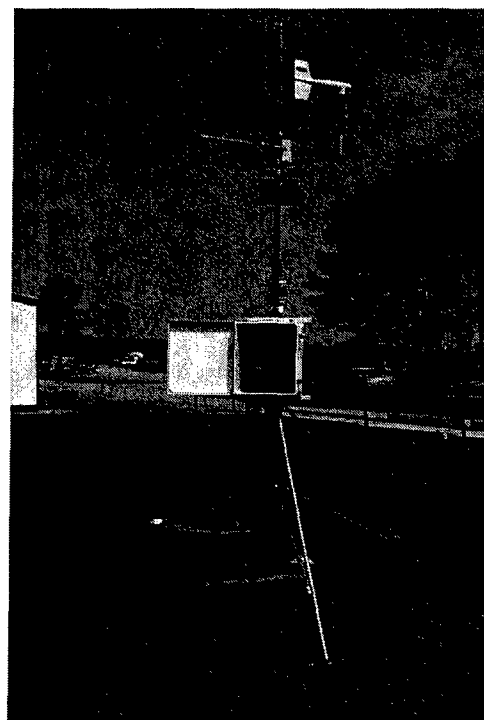


Figure 1. Automated weather station at Natural Resources Office

Table 1 Meteorological Data Collection Station Locations				
Station Name	UTM Zone 16 Coordinates		Geographic Coordinates	
	Easting	Northing	Latitude	Longitude
Natural Resources Office	700900	3584495	32°22'45.8"N	84°51'52.0"W
Griswald Range	697397	3573458	32°16'49.8"N	84°54'14.2"W
Pre-Ranger Site	703384	3577361	32°18'52.7"N	84°50'22.5"W
McKenna MOUT Site	706387	3583703	32°22'16.5"N	84°48'22.8"W
Cactus Microwave Tower	718705	3584593	32°22'36.9"N	84°40'31.0"W
Hastings Range	719893	3596608	32°29'06.0"N	84°39'35.5"W
Carmouche Range	710530	3595229	32°28'27.7"N	84°45'35.1"W
Malone Range #22	701525	3593400	32°27'34.4"N	84°51'21.2"W
Bama Site (off post)	691502	3571469	32°15'49.0"N	84°58'00.9"W
Lawson Army Airfield	688600	3579516	32°20'11.9"N	84°59'46.0"W

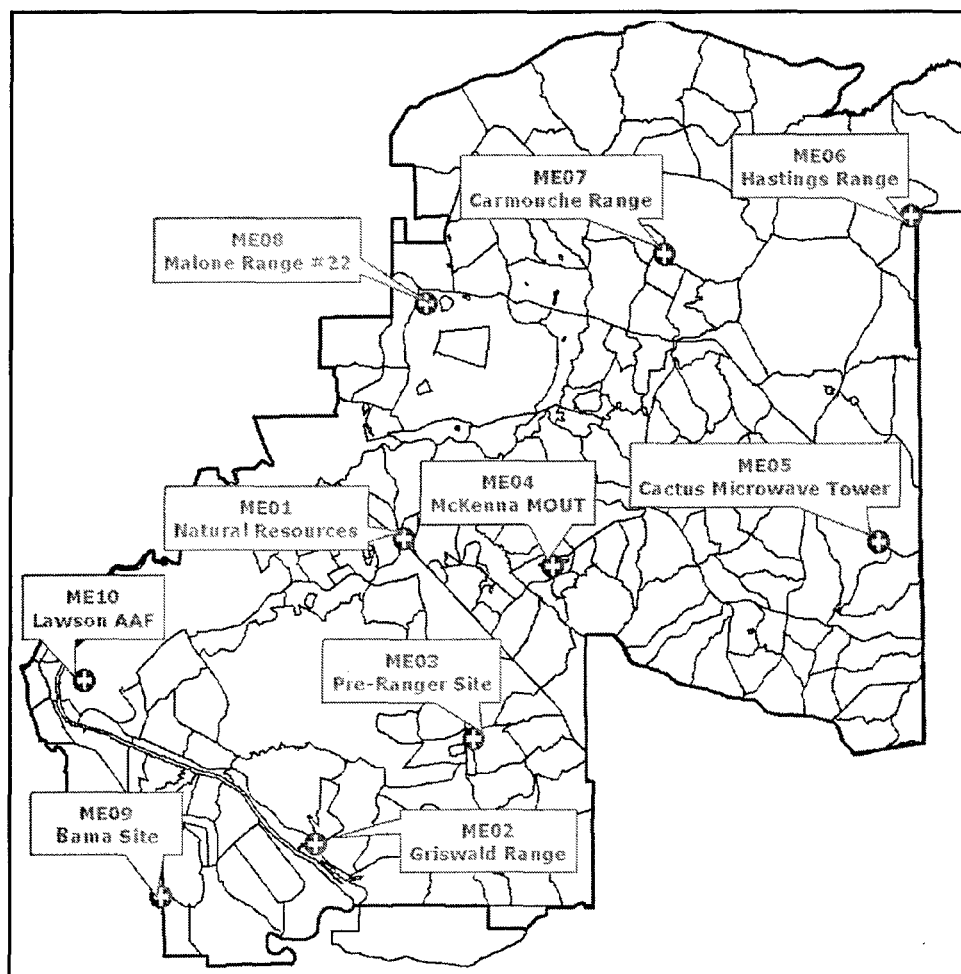


Figure 2. Map of meteorological station locations

Table 2 Meteorological Sensor Specifications		
Parameter	Manufacturer and Model	Specifications/Range
Air temperature	Vaisala Model HMP45C	$\pm 0.2^{\circ}\text{C}$ / -40° to $+60^{\circ}\text{C}$
Relative humidity	Vaisala Model HMP45C	$\pm 2\%$ / 0 to 90% $\pm 3\%$ / 90 to 100%
Barometric pressure	Vaisala Model PTB101B	± 8 mBar at -40 to $+60^{\circ}\text{C}$
Solar radiation	LiCor Model LI200X	$\pm 3\%$ (400- to 1100-nm band)
Wind speed	R.M. Young Model 05103-5	± 0.3 m/s / 0 to 100 m/s 1.0 m/s threshold
Wind direction	R.M. Young Model 05103-5	$\pm 5^{\circ}$ referenced to north
Precipitation	Texas Electronics Model TE525	$\pm 1\%$ / 0 to 10 mm/hr -3 to $+0\%$ / 10 to 20 mm/hr -5 to $+0\%$ / 20 to 30 mm/hr
Open water evaporation ¹	Weather Measure Model 6844-A (Gauge) Weather Measure Pan	± 0.4 mm / 0 to 150 mm 48 in. diam, 20 cm (8 in.) deep level limit at 15 cm (6 in.)
Wind speed (at evaporation pan) ¹	Met-One Model 014A	$\pm 1.5\%$ or 11 m/s / 0 to 45 m/s
¹ Sensors only deployed at Natural Resources Office site.		

Data from these stations are sampled every minute and 30-min averages are calculated and recorded using Campbell Scientific dataloggers. Each of the weather stations is equipped with cellular phone telemetry equipment, and data are retrieved daily by the ERDC EL at Vicksburg, MS.

Surface Water Data

Six surface water stations (Figure 3) were initially deployed in and around Fort Benning to record water depth, velocity, temperature, and other water quality parameters. In the photo, the velocity sensor is visibly mounted on top of the pipe housing the Hydrolab datasonde. The stage sensor is mounted at the bottom of this pipe, just above the streambed. Three of the stations (Bonham, Upatoi, and Sally Branch) were initially equipped with Hydrolab automatic water quality sensing datasondes. These datasondes were deployed for an extended period (approximately 14 months for Bonham and Sally Branch, and 6 months for Upatoi); however, the datasondes were removed due to low water conditions and the difficulty of maintaining sensor calibration and sensor function. It was determined that several sensors involved in the Hydrolab datasonde had either short operational lifespans or required frequent recalibration. The Hydrolab datasondes were removed during year 2000. Water quality sampling has been accomplished using manual sampling starting on 25 July 01, at 2-week intervals using the Hydrolab datasondes. Additional water quality sampling is done after rain events. The polyvinyl chloride (PVC) pipe used to support and protect the Hydrolab datasonde when deployed (Figure 3) also provides mounting for separate water temperature, stage, and velocity sensors. In August 2001, stream profiles were measured across each waterway as close to the in-water instrumentation package as possible. Stream profiles were measured at each of the streams being monitored using either a Leica NA2002 digital level or a Leica TCA1102 digital total station (used at Upatoi). A sample profile is shown in Figure 4. Station locations are shown in Table 3 and Figure 5.

Each station is equipped with stage sensors. Additionally, Bonham Creek and Sally Branch Creek stations were equipped with water velocity sensors after the initial deployment in August 1999. Upatoi Creek was equipped with a velocity sensor in August 2001. Upatoi, Oswichee, Randall, and Little Pine Knot Creeks are also equipped with thermistors to measure water temperature. Specifications for these sensors and the sensors deployed on the Hydrolab datasondes are shown in Table 4.



Figure 3. Automated water station

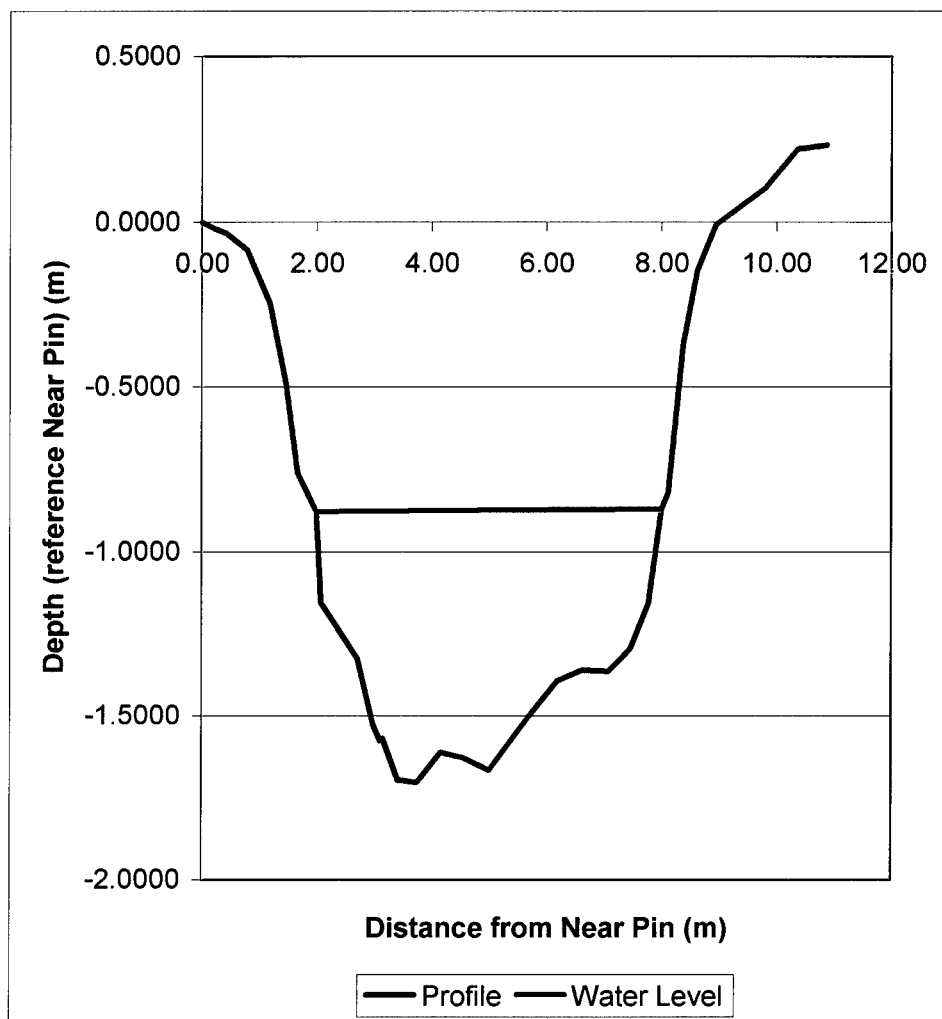


Figure 4. Stream profile at Sally Branch Creek

Table 3 Surface Water Data Collection Station Locations				
Station Name	UTM Zone 16 Coordinates		Geographic Coordinates	
	Easting	Northing	Latitude	Longitude
Bonham Creek ¹	710244	3589781	32°25'31.1"N	84°45'50.5"W
Little Pine Knot Creek	716628	3589413	32°25'14.8"N	84°41'46.5"W
Oswichee Creek	693975	3579182	32°18'20.4"N	84°56'23.0"W
Randall Creek	707641	3593111	32°27'21.0"N	84°47'27.4"W
Sally Branch Creek ¹	712638	3591274	32°26'18.0"N	84°44'17.6"W
Upatoi Creek ¹	716240	3600304	32°31'08.5"N	84°41'52.3"W
¹ Location of Hydrolab datasondes.				

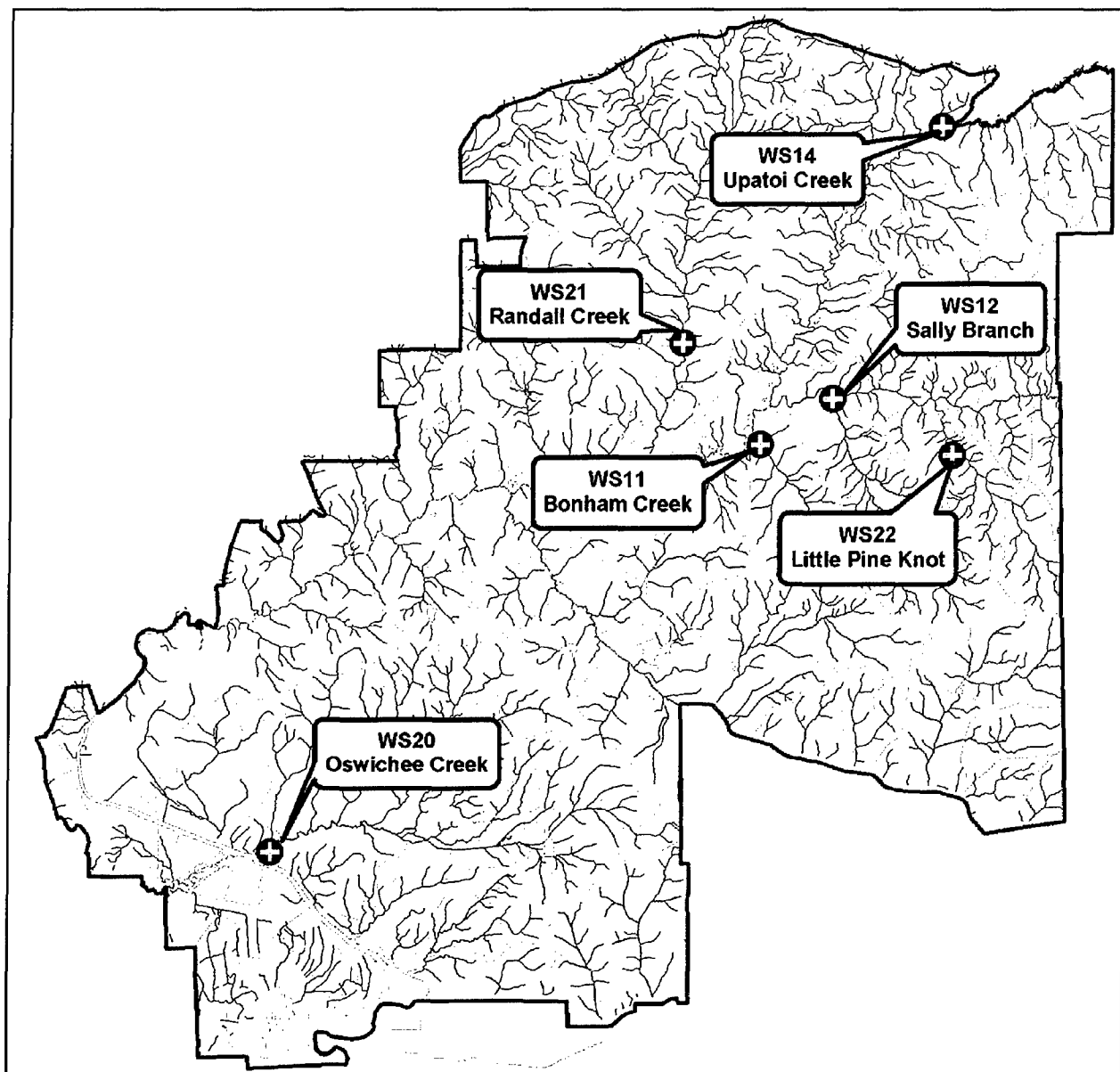


Figure 5. Map of water station locations

Table 4 Surface Water Sensor Specifications		
Parameter	Manufacturer/Model	Specifications/Range
Stage	Druck/Model PDCR 1830	±0.1%/0 to 3 m
Velocity	Rocky Mountain Instrument/Model VMT	±2%/0 to 4.5 m/s
Water temperature	Hydrolab	±0.1°/-5° to 50°C
pH	Hydrolab	±0.2/0 to 14
Turbidity	Hydrolab	±2.6%/0 to 100 NTU
Dissolved oxygen	Hydrolab	±0.2 mg/L / 0 to 200 mg/L
Specific conductivity	Hydrolab	±1%/0 to 100 mS/cm
Water temperature	Campbell Scientific/Mod 107	±0.1°C/-24° to +48°C

Data from these sites are being sampled at 1-min intervals (30-min samples for the Hydrolab sensors), and 30-min averages are recorded using Campbell Scientific dataloggers. The Bonham Creek, Sally Branch, and Upatoi Creek stations are also equipped with cellular phone telemetry, and the data are retrieved daily. The other stations (Randall Creek, Little Pine Knot Creek, and Oswichee Creek) store data into removable storage modules which are retrieved on a biweekly basis.

Groundwater Data

Water wells were drilled to a depth of 15 m (50 ft) at Sally Branch, Oswichee Creek, Randall Creek, and Little Pine Knot Creek to monitor groundwater depth and temperature. In-Situ Trolls/Mini Trolls (specifications in Table 5) were deployed in each well to monitor water depth and temperature. Data from these sensors are retrieved monthly. A well was also drilled at Bonham Creek; however, no water was detected to a depth of 15 m (50 ft), and the well was grouted and sealed.

Table 5		
Groundwater Sensor Specifications		
Parameter	Manufacturer/Model	Specifications/Range
Groundwater depth	In-Situ/Troll/Mini-Troll	$\pm 0.2\%$ / <11 m (35 ft)
Groundwater temperature	In-Situ/Troll/Mini-Troll	$\pm 0.25^\circ\text{C}$ / -5° to $+50^\circ\text{C}$

3 Data Summaries

Meteorological Data

Data from several of the meteorological parameters have been examined. These parameters include air temperature, wind speed, wind direction, and precipitation. Table 6 presents the maximum and minimum seasonal air temperatures for each station. These numbers are the extreme maximum and minimum temperatures recorded. Table 7 presents the average daily maximum and minimum temperatures during each day.

Figure 6 illustrates the average maximum daily temperature averaged over the season. Figure 7 shows the average daily minimum temperature averaged over the season. Figure 8 presents the seasonal maximum average daily wind speed. Figure 9 presents the mean average wind speed (seasonal average wind speed). Figure 10 illustrates the range of total daily solar radiation measured at

Table 6
Seasonal Maximum and Minimum Air Temperature (deg C)

Season	Bama	Cactus	Carmouche	Griswald	Hasting	LA AF	Malone	McKenna	NR1 ¹	Ranger
Maximum										
Summer 1999	38.5	37.7	37.8	39.3	38.6	40.4	43.2	37.8	N/I	37.7
Fall 1999	31.7	31.2	31.9	32.6	31.8	32.2	31.6	31.0	N/I	32.9
Winter 2000	27.7	27.5	27.1	27.9	26.7	27.3	27.2	27.1	N/I	28.1
Spring 2000	36.0	35.7	35.3	36.4	35.2	35.5	36.2	35.4	36.9	36.3
Summer 2000	40.2	39.6	39.5	41.9	39.1	40.4	40.5	39.8	40.6	39.9
Fall 2000	32.0	31.5	31.7	31.9	31.7	32.0	31.6	31.3	32.1	32.1
Winter 2001	25.9	25.2	25.5	25.9	25.6	26.0	25.8	25.3	26.0	26.5
Spring 2001	33.0	33.4	32.9	33.6	32.2	33.0	33.3	32.6	No data	32.9
Minimum										
Summer 1999	9.6	13.0	10.6	8.9	12.8	11.2	10.6	10.1	N/I	8.4
Fall 1999	-4.2	-1.7	-4.0	-4.6	-3.5	-4.3	-4.0	-3.3	N/I	-5.0
Winter 2000	-7.3	-6.7	-7.2	-7.1	-7.5	-7.8	-7.3	-7.1	N/I	-8.1
Spring 2000	-0.6	0.9	-0.3	-1.0	-0.2	-0.1	-1.1	-0.5	-0.4	-1.6
Summer 2000	11.7	12.6	12.4	11.4	12.2	12.8	12.2	11.4	12.7	10.2
Fall 2000	-9.5	-10.1	-9.8	-8.9	-10.2	-9.2	-9.4	-9.1	-9.3	-9.3
Winter 2001	-9.9	-8.5	-9.7	-9.9	-8.6	-10.7	-9.8	-10.1	-8.2	-11.4
Spring 2001	-0.4	2.1	0.5	-0.2	0.1	-0.5	-0.8	0.1	No data	-0.8

¹ N/I = Not Installed. Natural Resources Station not installed until 15 March 2000.

Table 7 Average Daily Maximum and Minimum Temperature (deg C)										
Season	Bama	Cactus	Carmouche	Griswald	Hasting	LAAF	Malone	McKenna	NR1 ¹	Ranger
Maximum										
Summer 1999	32.97	32.01	32.54	33.43	32.38	33.33	32.74	32.46	N/I	32.96
Fall 1999	22.75	22.23	22.49	23.23	22.52	23.00	22.69	22.37	N/I	23.25
Winter 2000	18.29	17.67	17.74	18.77	17.67	18.47	18.22	17.94	N/I	18.72
Spring 2000	29.16	28.59	28.53	29.45	28.38	28.81	28.78	28.59	28.56	29.17
Summer 2000	33.41	32.62	32.63	33.59	32.38	33.14	33.05	32.72	33.30	33.40
Fall 2000	20.53	20.08	20.15	20.97	20.03	20.72	20.47	20.24	20.53	21.06
Winter 2001	15.85	15.47	15.60	16.38	15.40	16.02	15.85	15.65	15.32	16.41
Spring 2001	27.32	26.99	27.04	27.70	26.66	27.25	27.20	26.91	No data	27.47
Minimum										
Summer 1999	19.06	20.11	19.66	19.55	19.11	19.69	19.35	19.78	N/I	18.94
Fall 1999	8.43	11.39	9.14	8.62	9.17	8.41	9.10	9.16	N/I	8.05
Winter 2000	3.90	6.21	4.47	3.90	4.82	3.30	4.52	4.59	N/I	3.30
Spring 2000	13.79	15.60	14.48	14.22	14.62	13.80	14.21	14.66	14.50	13.49
Summer 2000	19.84	21.06	20.30	20.36	20.20	20.17	20.02	20.38	20.63	19.65
Fall 2000	6.75	9.23	7.10	6.99	7.20	6.75	6.98	7.16	7.63	6.47
Winter 2001	3.33	4.83	3.80	3.51	3.78	2.86	3.71	3.76	3.78	3.00
Spring 2001	13.71	15.41	14.27	13.94	14.21	13.36	13.86	14.33	No data	13.31

¹ N/I = Not Installed. Natural Resources Station not installed until 15 March 2000.

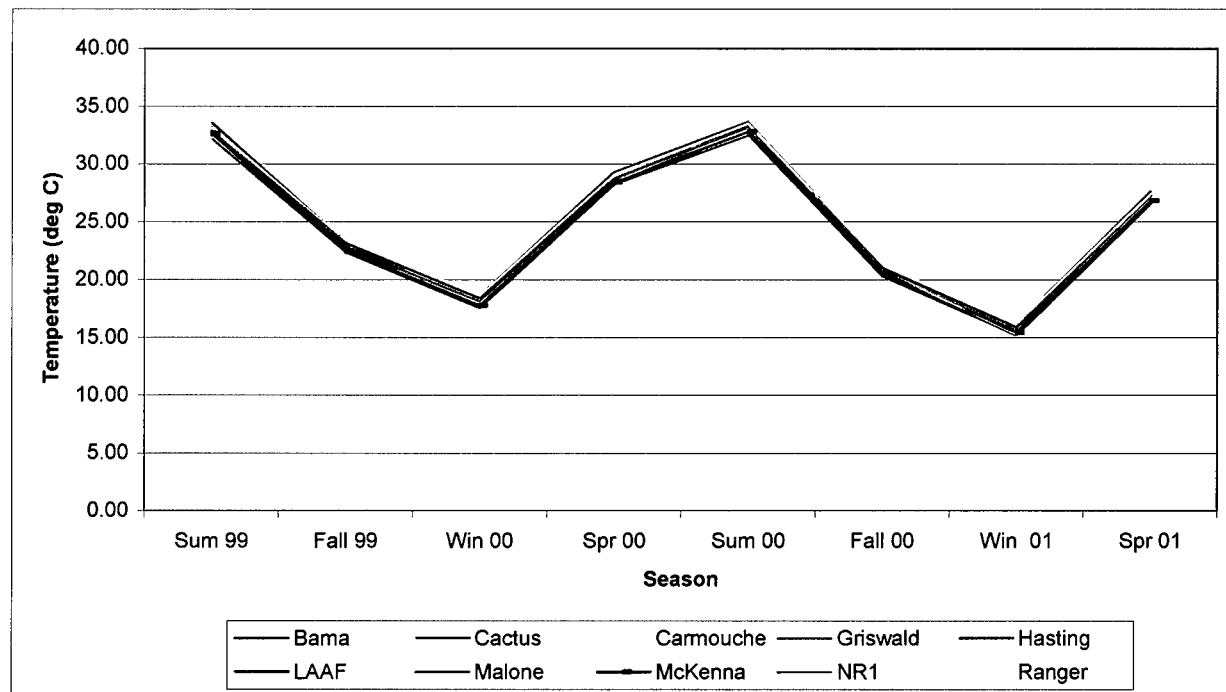


Figure 6. Average daily maximum temperature

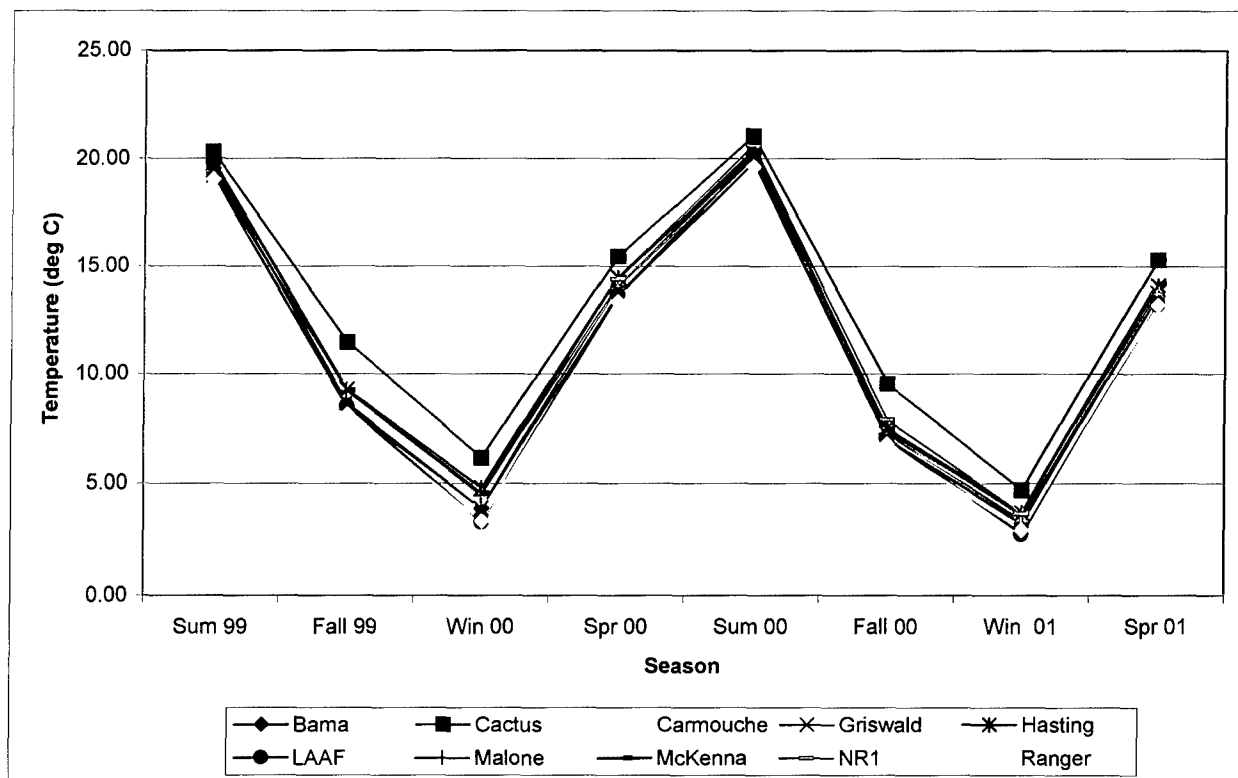


Figure 7. Average daily minimum temperature

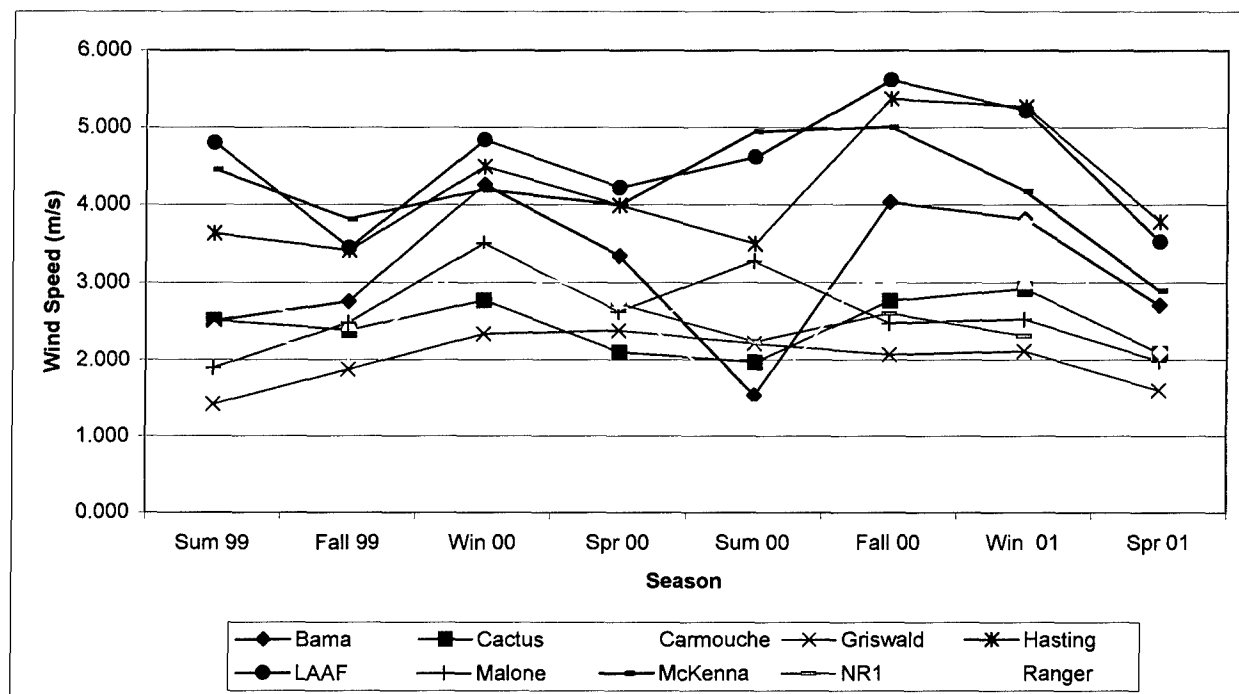


Figure 8. Maximum average daily wind speed

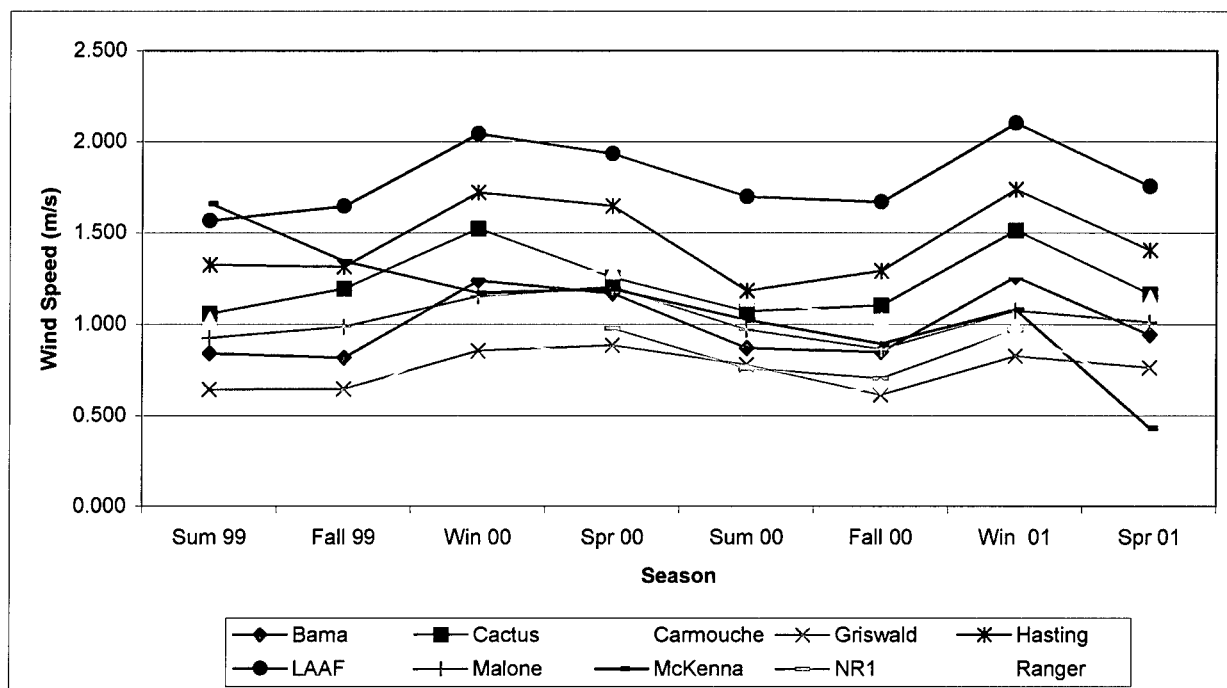


Figure 9. Seasonal average wind speed

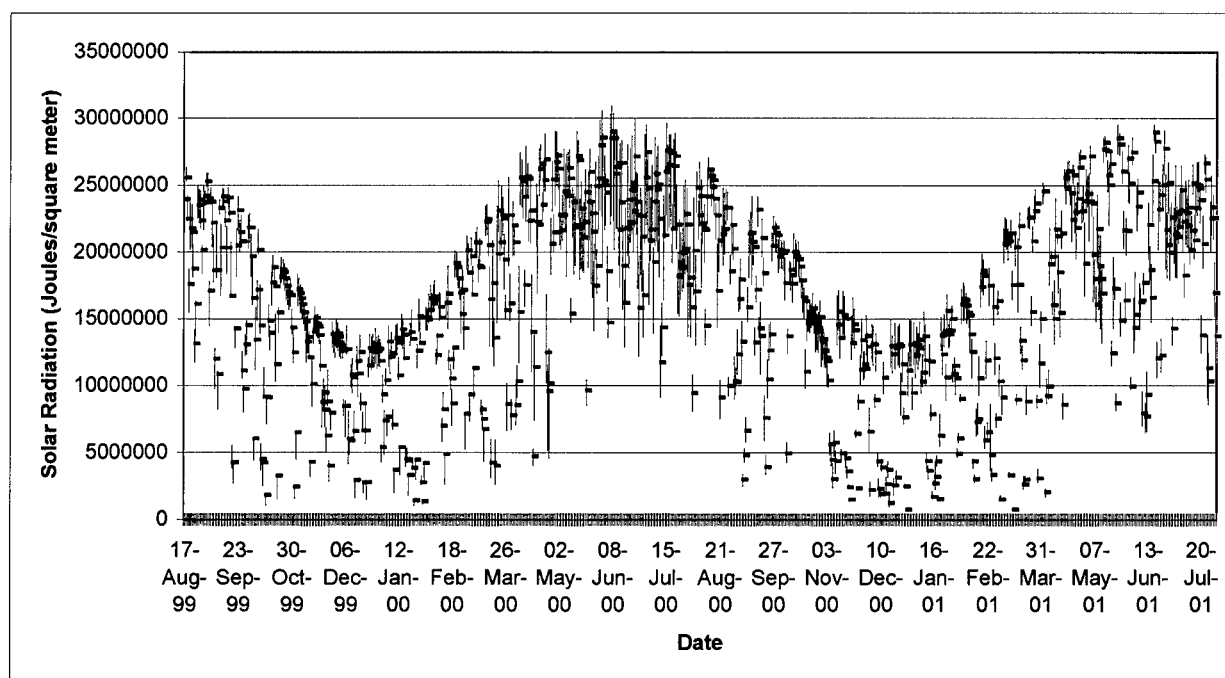


Figure 10. Total daily solar radiation

the ten meteorological stations at Fort Benning. Figure 11 presents the range of minimum measured daily relative humidity encountered at Fort Benning. Figure 12 presents the range of the average daily barometric pressure averaged again across the stations. Figure 13 presents monthly precipitation totals for all of

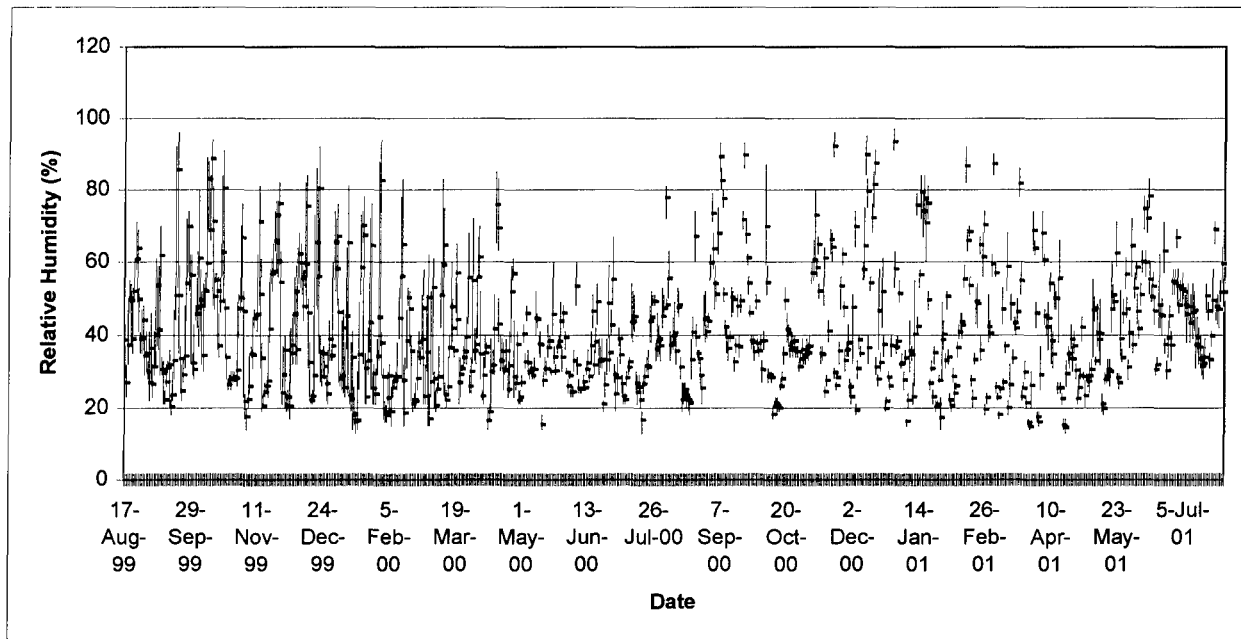


Figure 11. Daily relative humidity

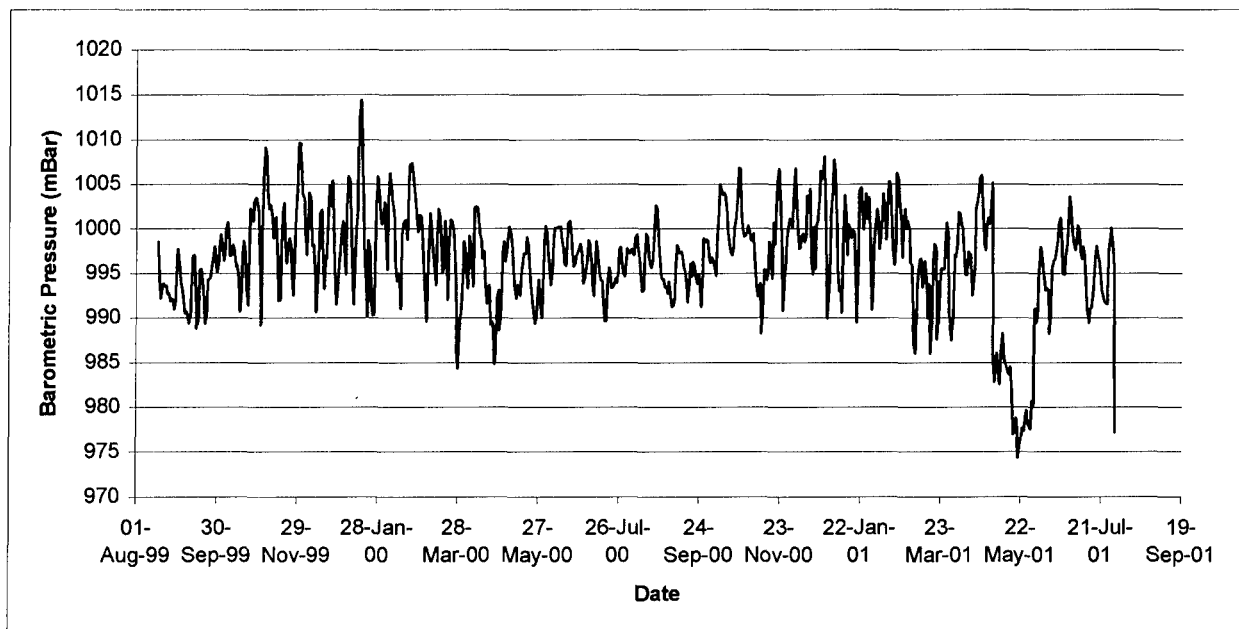


Figure 12. Daily average barometric pressure

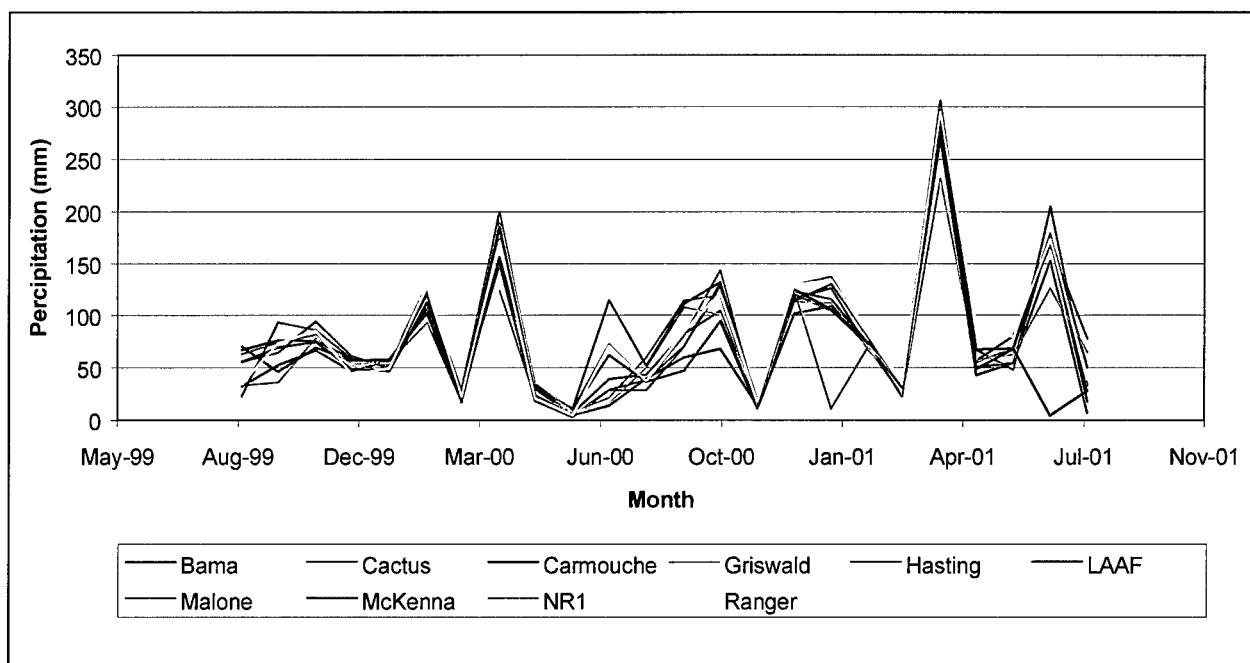


Figure 13. Monthly precipitation

the stations. It is important to note that during this June 2001 period the rain bucket at the McKenna MOUT site was clogged with debris and failed to accurately record precipitation. Figure 14 presents seasonal precipitation. Figure 15 represents the evaporation measured only in the pan at the Natural Resources station.

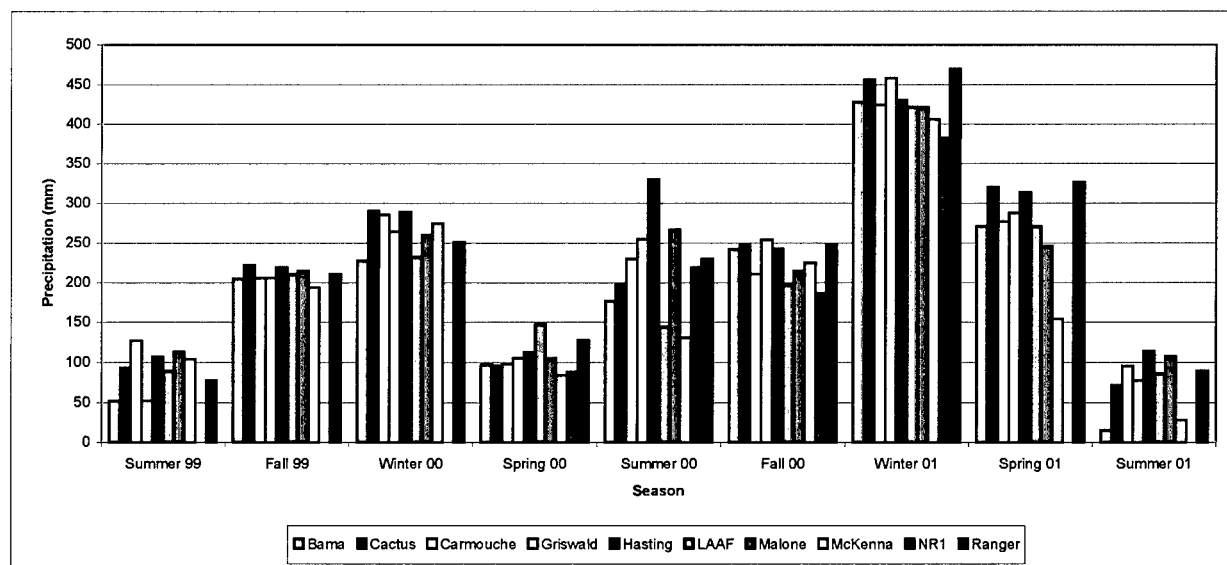


Figure 14. Seasonal precipitation

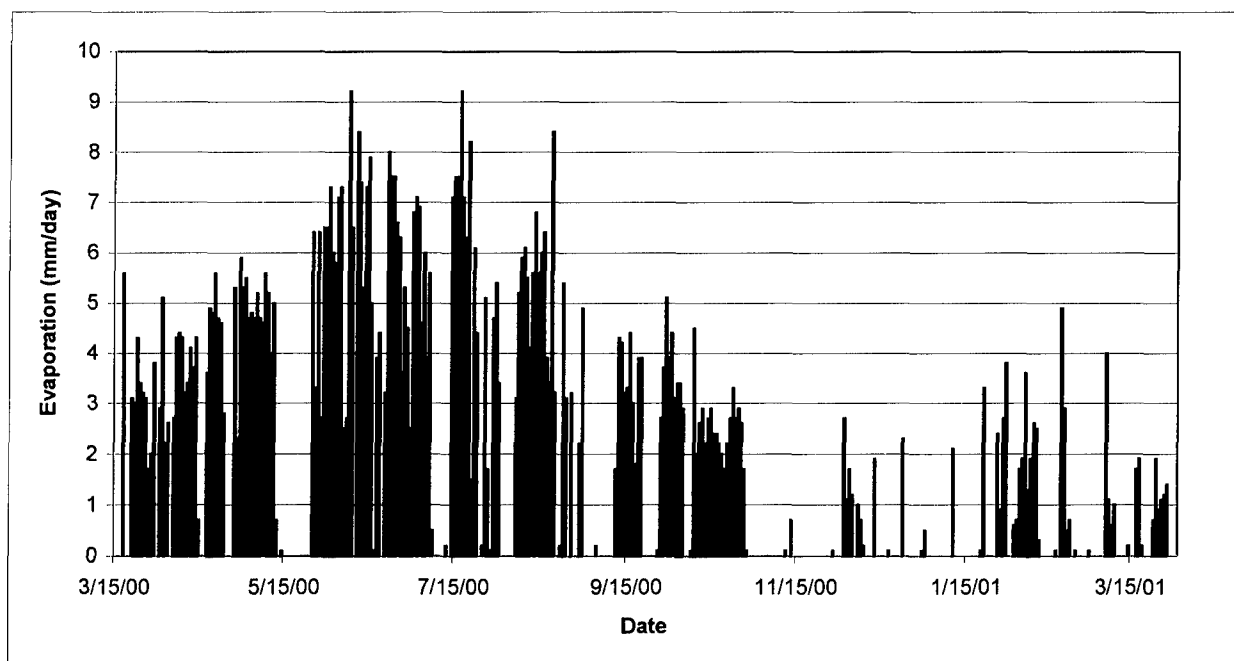


Figure 15. Daily pan evaporation

Surface Water Data

Data from each of the surface water parameters were examined. These parameters included water stage, water temperature, pH, turbidity, dissolved oxygen (DO), specific conductivity, and water velocity. Daily averages of each of these parameters were calculated and plotted for the data available. Data collected with the Hydrolab instruments (water temperature, pH, turbidity, DO, and specific conductivity) are limited to Bonham Creek, Sally Branch Creek, and Upatoi Creek and were limited in quantity. Figures 16-21 show the average daily water stage (level) at the stations. Zero is referenced to the sensor, which is located just above the stream bottom (<5 cm above the streambed). Figure 22 shows the average daily water temperature. Figure 23 presents average daily pH.

Stream Profile Data

In August of 2001, stream profiles were measured at each of the stations. Lines were marked perpendicular to the stream channel, passing as close to the stream instrumentation as possible. Differential elevations were then measured using either a Wild NA2002 digital level or a Leica TCA1102 digital total station (Upatoi Creek only). Metal pins were placed on either side of the creek to mark the ends of the profile line. Locations for these pins will be surveyed in the second quarter of fiscal year 2002. Figures 24-29 show these surveyed profiles and the associated elevation data.

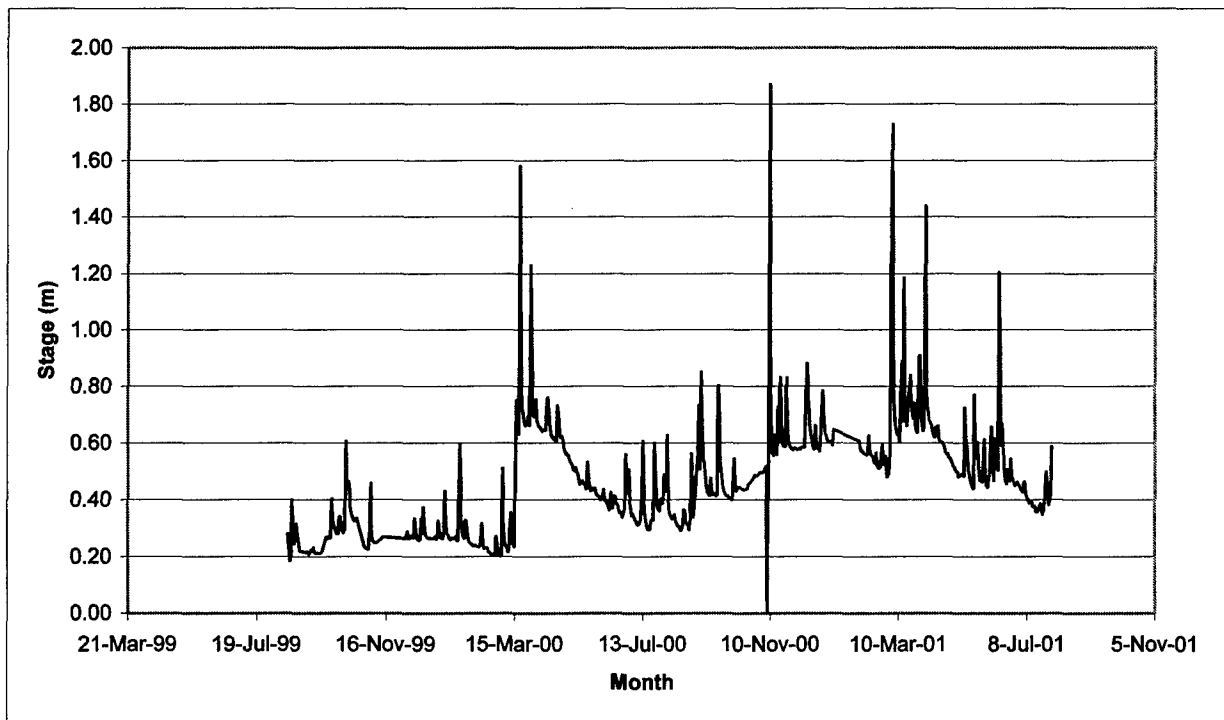


Figure 16. Average daily water stage, Bonham Creek

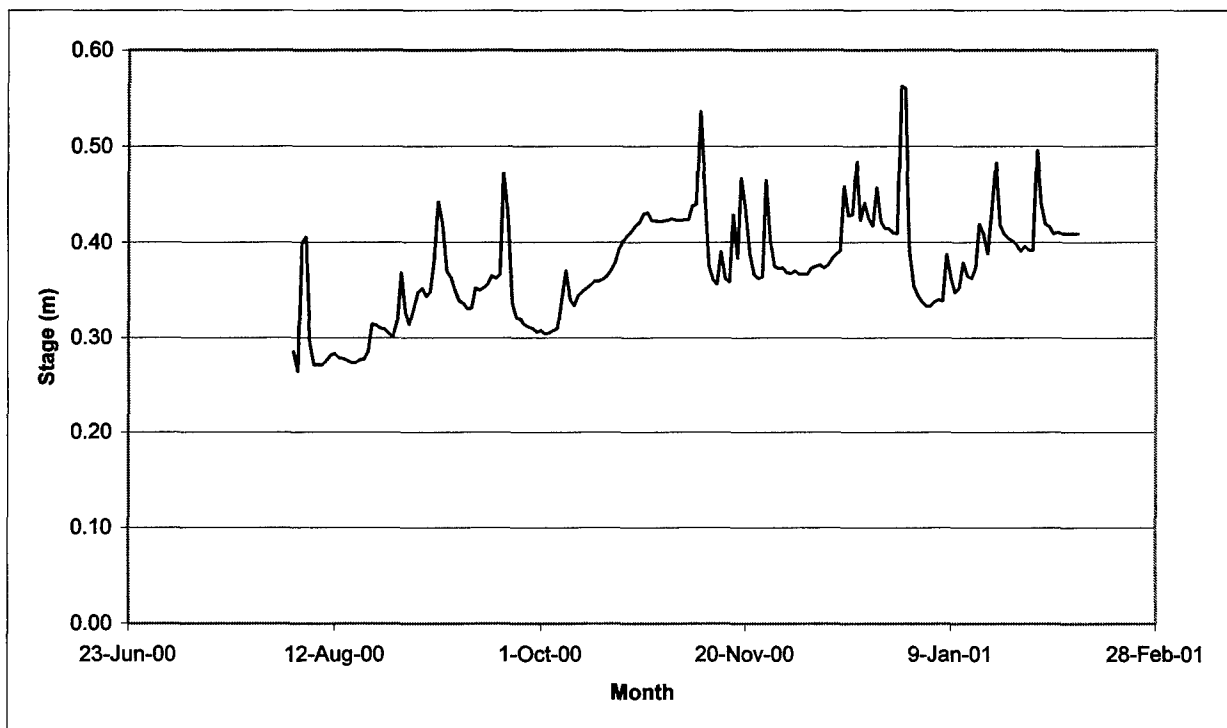


Figure 17. Average daily water stage, Little Pine Knot Creek

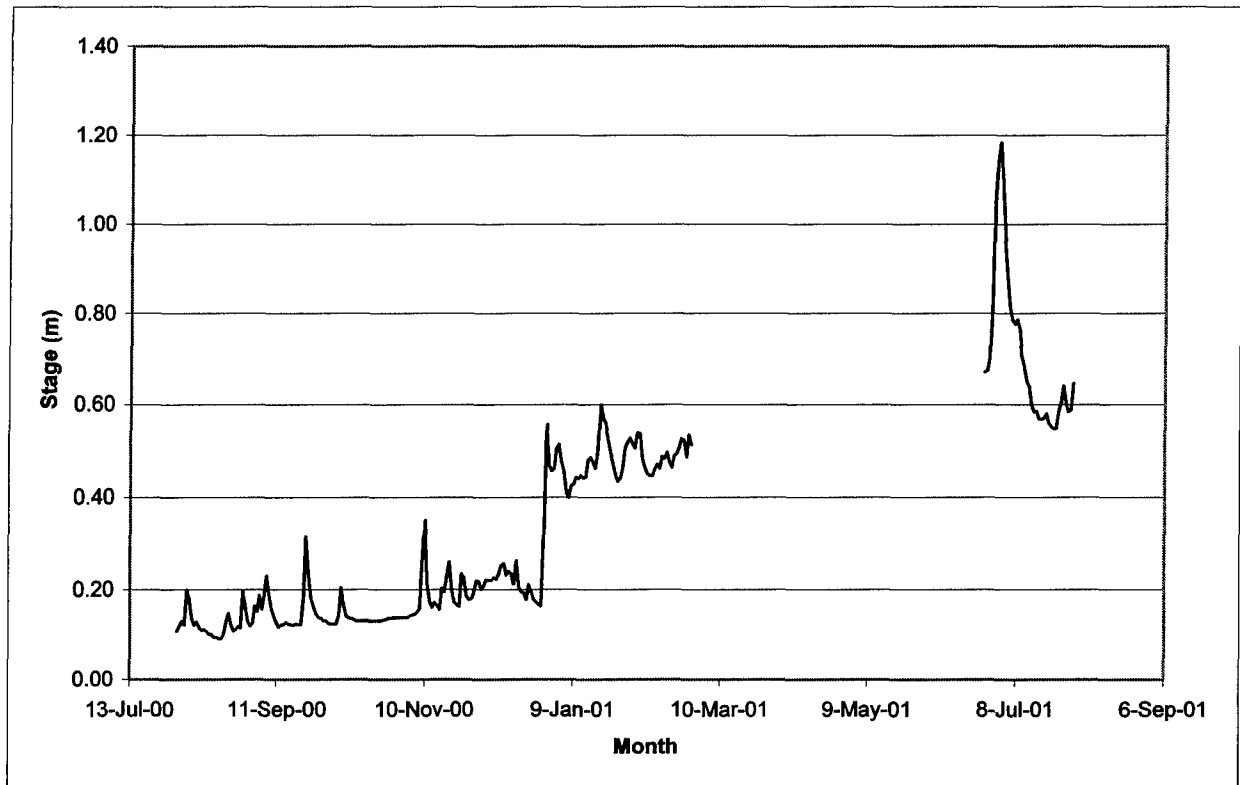


Figure 18. Average daily water stage, Oswichee Creek

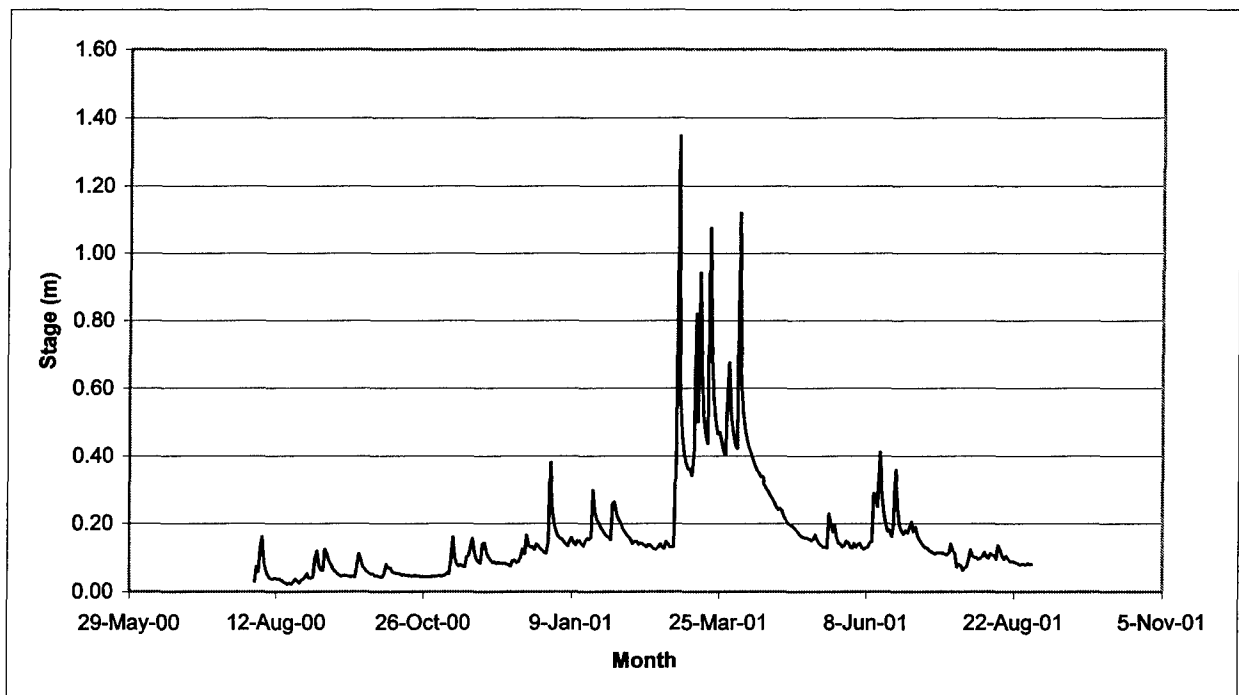


Figure 19. Average daily water stage, Randall Creek

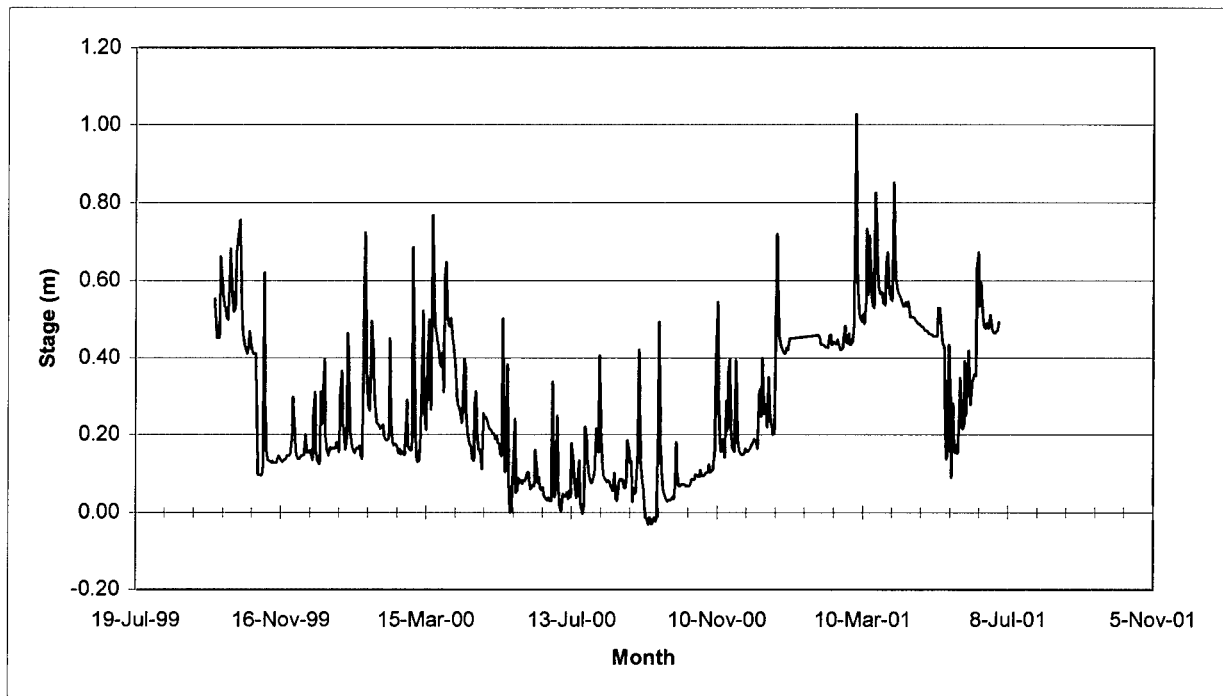


Figure 20. Average daily water stage, Sally Branch Creek

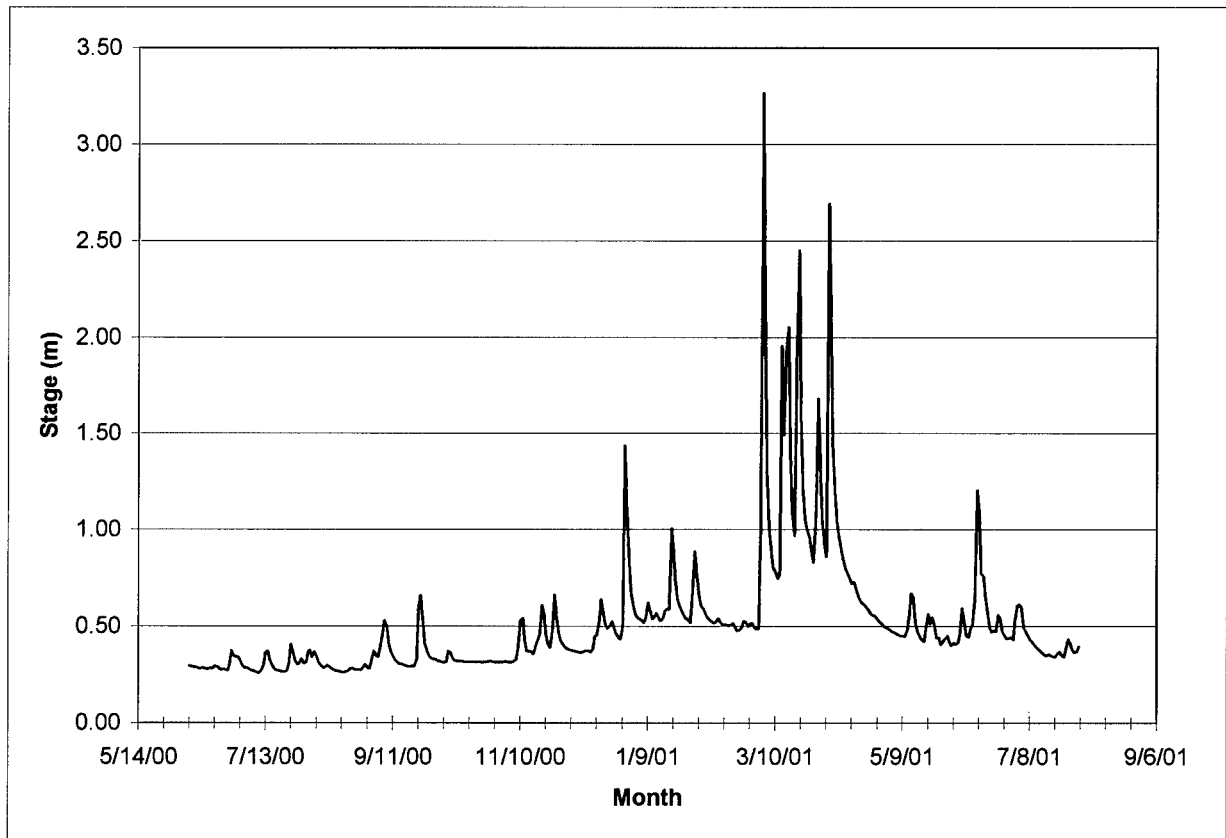


Figure 21. Average daily water stage, Upatoi Creek

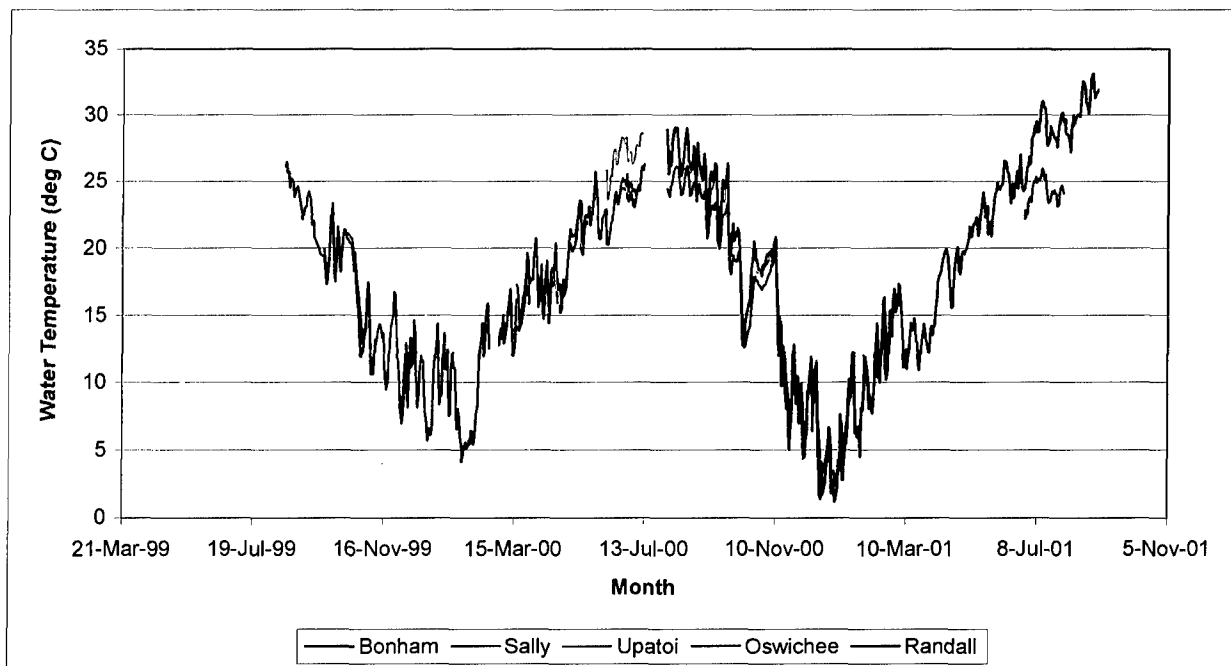


Figure 22. Average daily water temperature

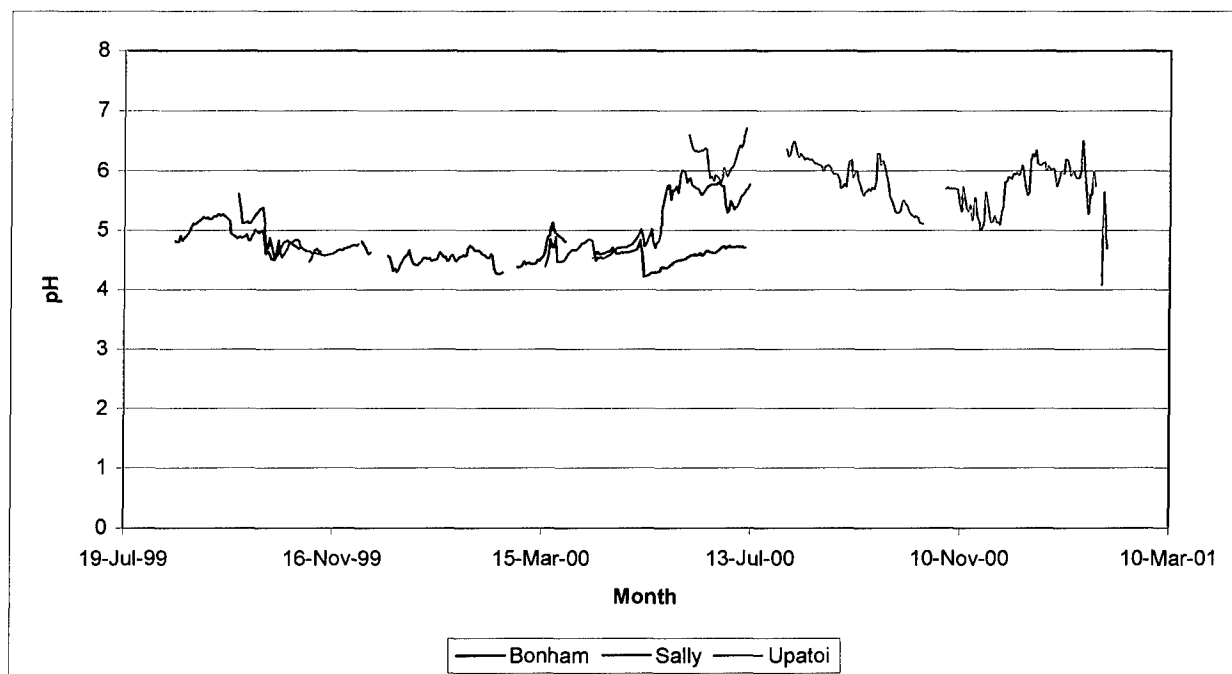


Figure 23. Average daily pH

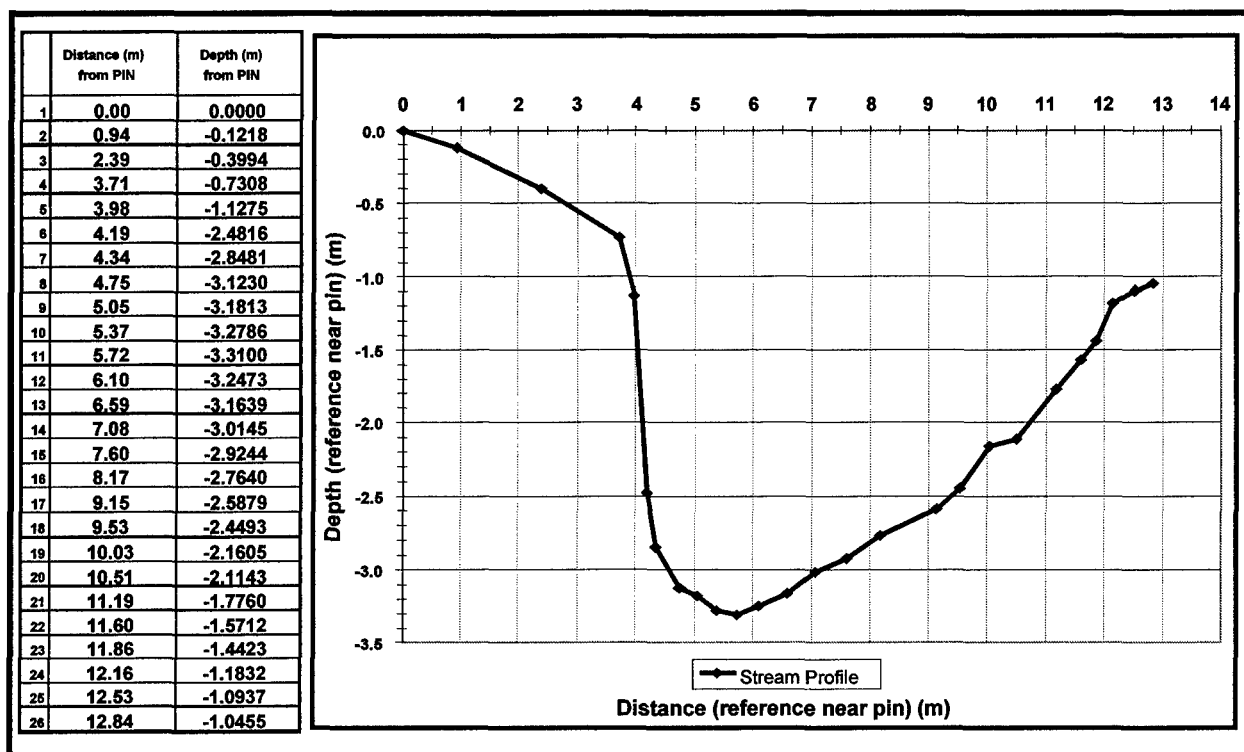


Figure 24. Bonham Creek profile (looking downstream)

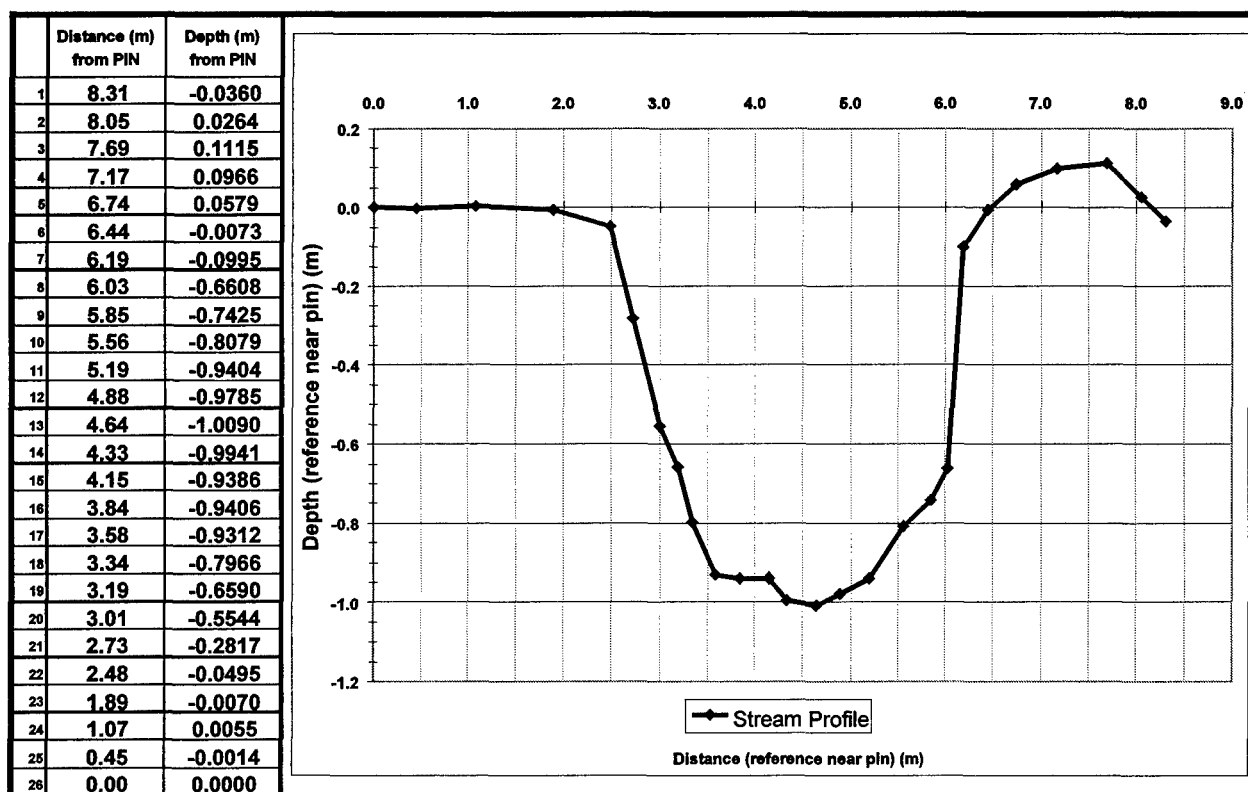


Figure 25. Little Pine Knot Creek profile

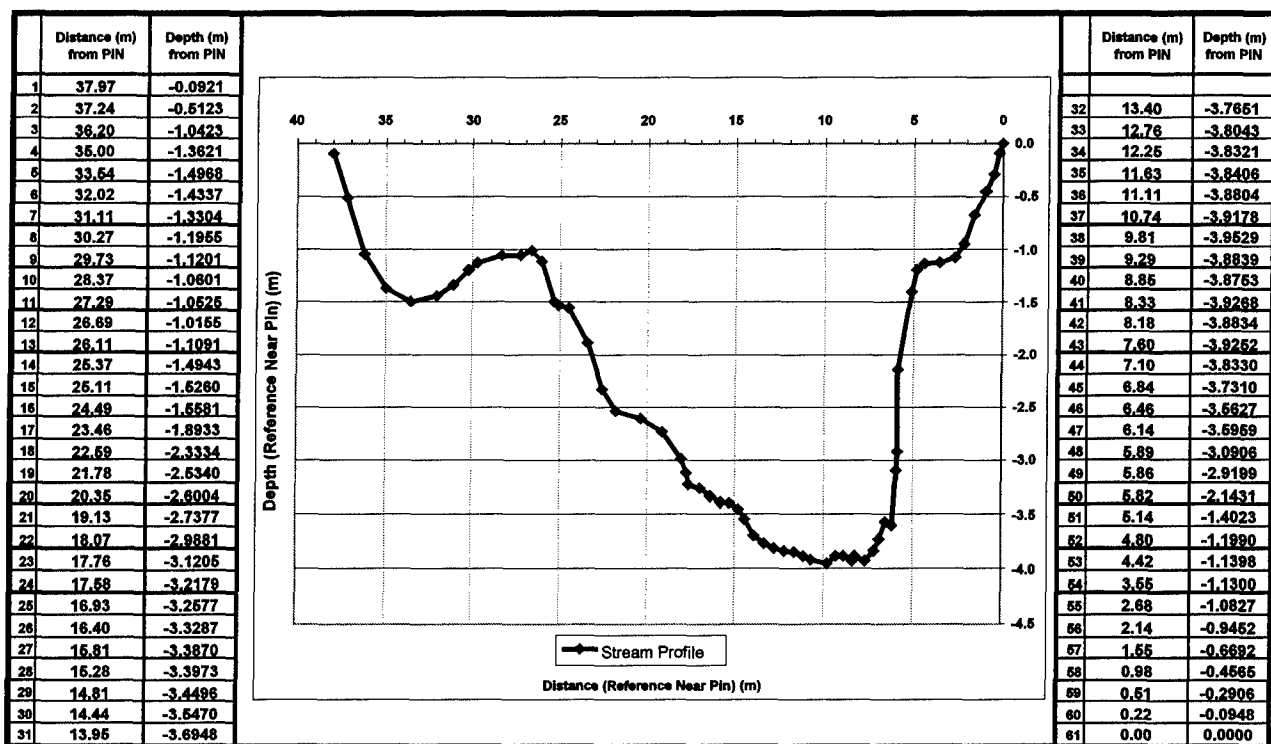


Figure 26. Oswichee Creek profile

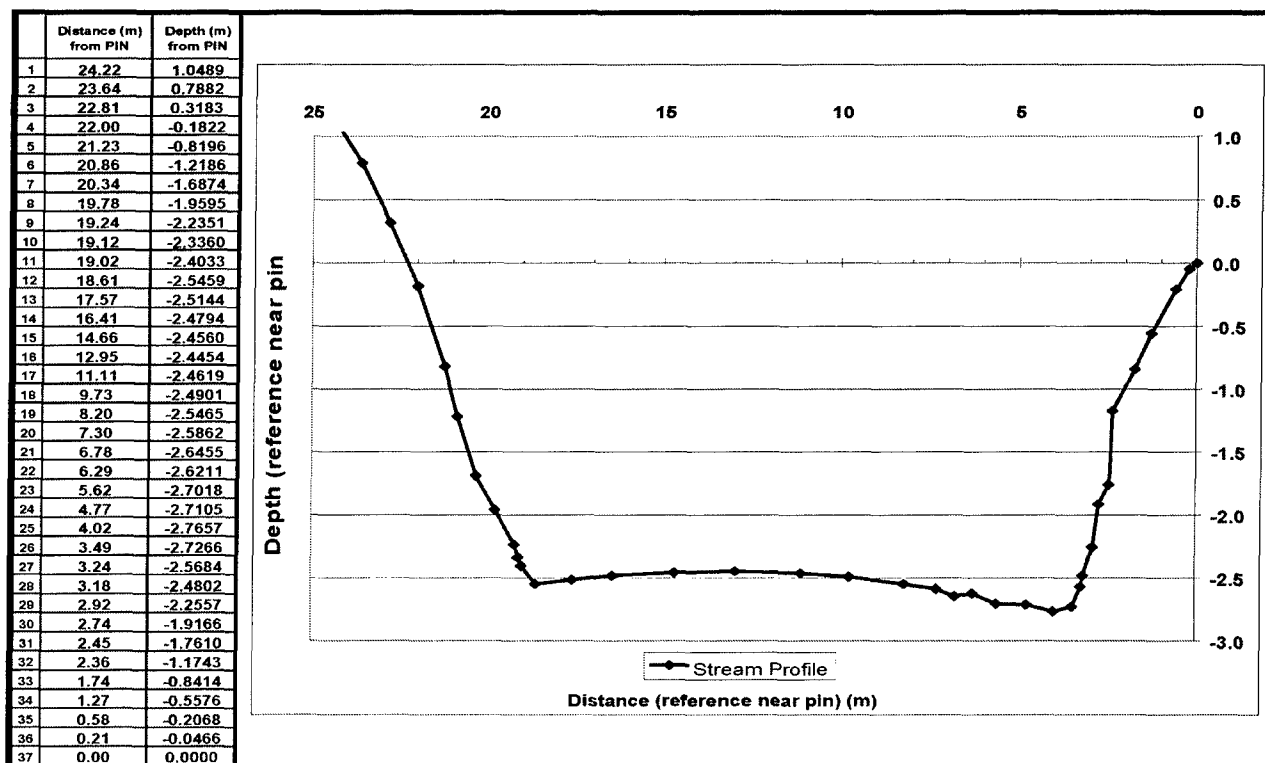


Figure 27. Randall Creek profile

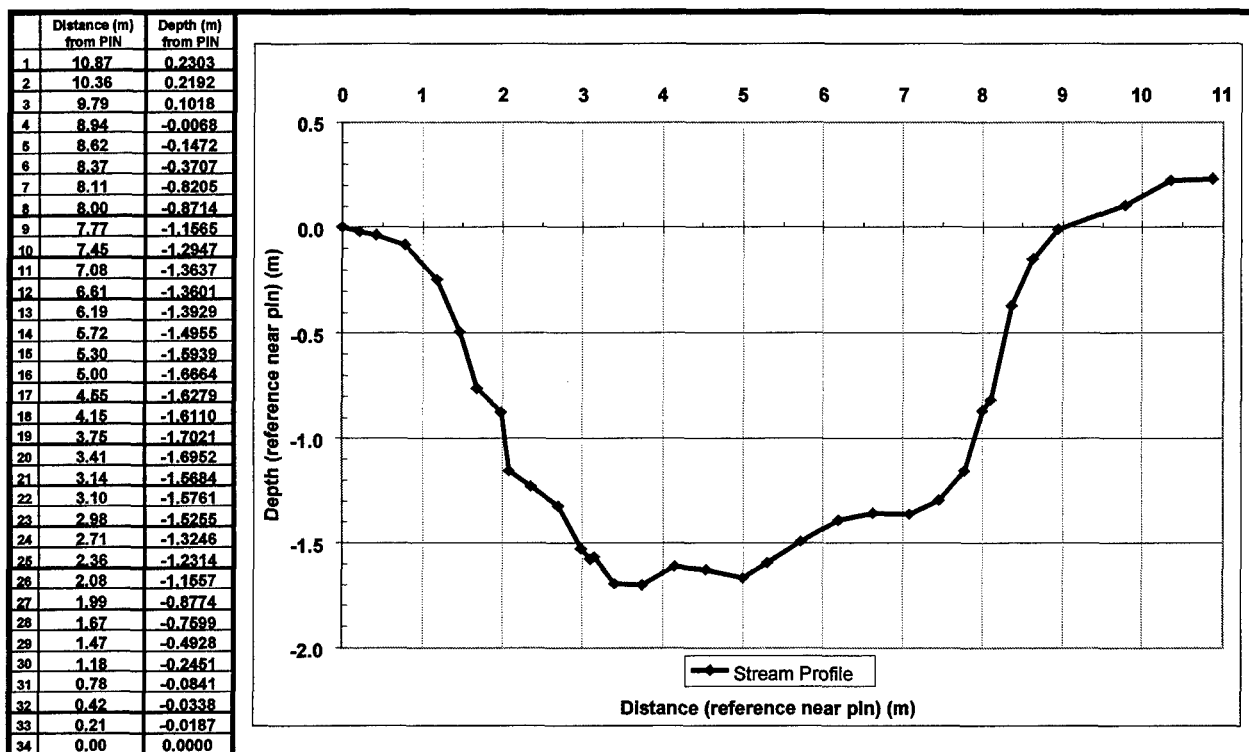


Figure 28. Sally Branch Creek profile

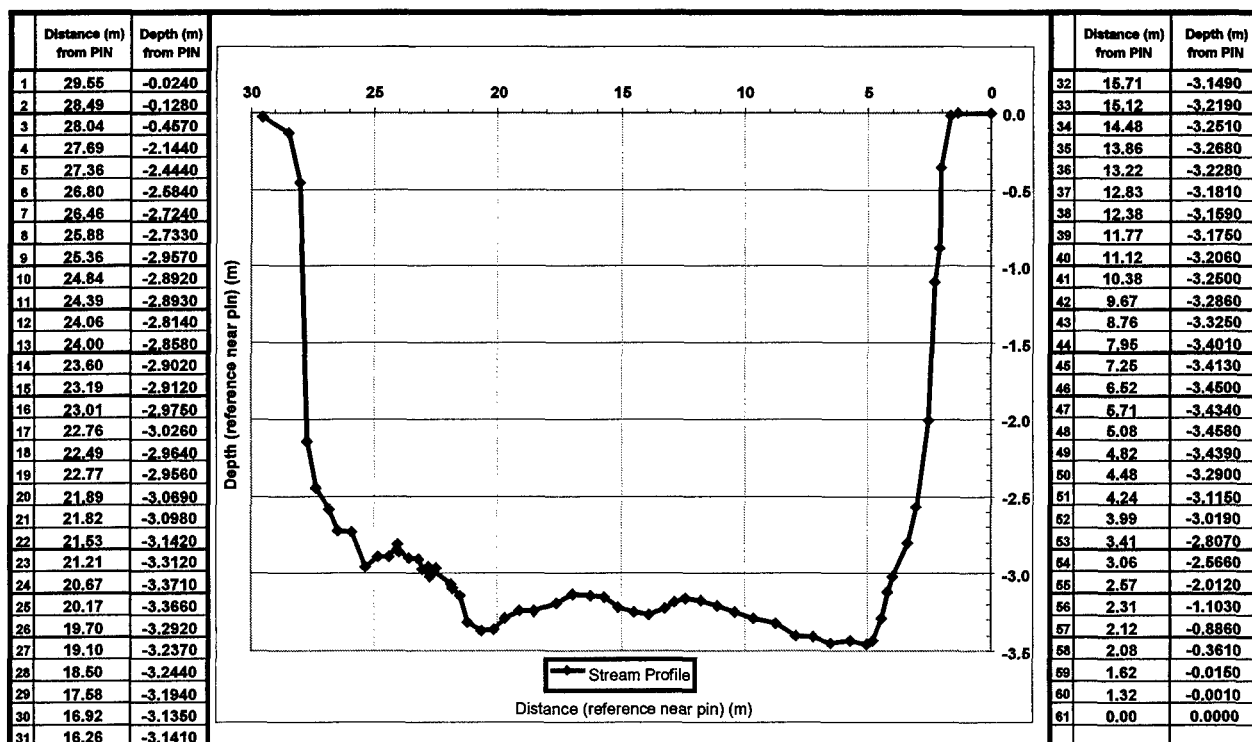


Figure 29. Uptoi Creek profile

Groundwater Well Data

In June 2001, five groundwater sampling wells (Figure 30) were drilled at Bonham Creek, Little Pine Knot Creek, Oswichee Creek, Randall Creek, and Sally Branch Creek. No groundwater was found to a depth of 15 m (50 ft) at Bonham Creek, and that well was grouted and sealed. In-Situ Trolls/Mini-Trolls were deployed in each well to monitor water table depth and water temperature. Each instrument was configured to collect temperature and depth measurements at 30-min intervals. Groundwater depth measurements are referenced to the top of the well casing. These wells have not been surveyed. The wells are scheduled to be surveyed as part of the second quarter of fiscal year 2002 work. Groundwater temperature (as available) is shown in Figure 31.

Figure 32 shows the depth of the groundwater as measured from the top of the well casing to the top of the water.



Figure 30. Groundwater well

Manually Sampled Water Data

Beginning in July 2001, a decision was made to manually sample the water chemistry data using the Hydrolab datasondes. The sondes are calibrated prior to each sampling mission as part of the standard sampling procedure. Data were to be collected at 2-week intervals at each of the six stations. Table 8 presents these manually sampled data.

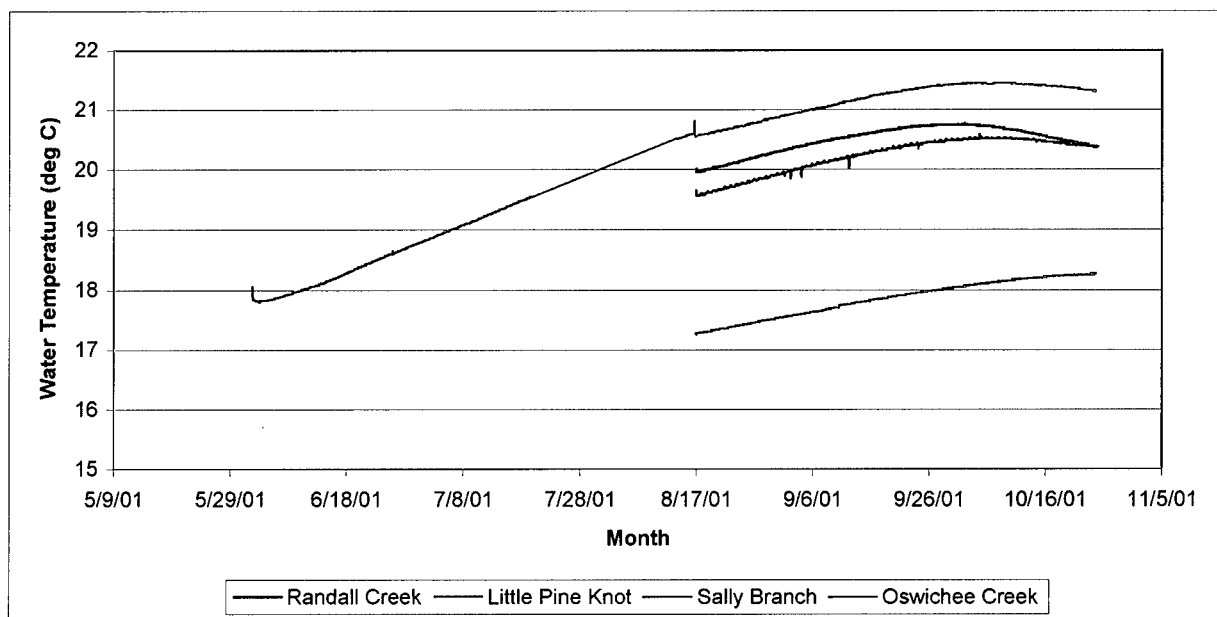


Figure 31. Groundwater temperature

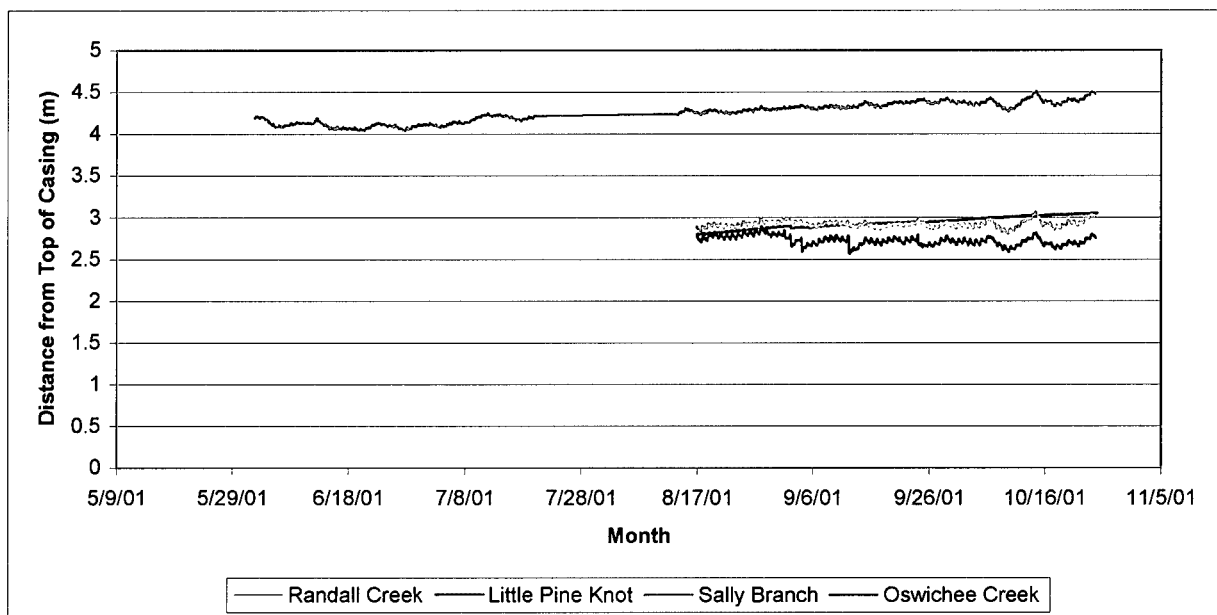


Figure 32. Groundwater depth

Table 8
Water Quality Data

Date	DO, %	DO, mg/L	pH	Water Temp deg C	Depth, m	Specific Conductivity μ Siemens/cm	NO3 mg/L	Comment
Bonham Creek								
7/25/01	90.5	7.51	4.32	23.90	0.30	16	NR ¹	
8/10/01	91.5	7.65	4.00	24.10	0.78	16	NR	
8/24/01	83.4	7.24	4.01	22.30	0.79	16	NR	
9/10/01	87.5	7.42	3.37	23.00	0.82	15	0.03	
9/24/01	94.3	8.15	3.78	21.80	0.70	15	NR	Raining, NO3 probe failed
10/10/01	82.0	8.08	3.94	16.10	0.70	14	0.00	
10/23/01	79.6	7.83	3.93	15.64	1.00	16	0.00	
Little Pine Knot Creek								
7/25/01	93.3	7.60	4.48	22.70	0.32	24	NR	
8/10/01	80.4	6.89	4.18	22.90	0.36	17	NR	
8/24/01	80.6	7.05	4.45	21.80	0.33	19	NR	
9/10/01	81.0	7.02	3.59	22.10	0.46	18	0.08	
9/24/01	84.9	7.39	3.82	21.00	0.60	19	NR	Raining, NO3 probe failed
10/10/01	78.8	7.71	3.83	16.40	0.45	18	0.00	
10/23/01	75.7	7.59	3.97	15.46	0.52	20	0.00	
Randall Creek								
7/25/01	104.1	8.03	7.51	28.70	0.15	81	NR	
8/10/01	100.2	8.15	6.06	25.84	0.15	80	NR	
8/24/01	100.5	8.26	6.62	25.30	0.17	70	NR	
9/10/01	103.2	7.51	6.36	32.17	0.22	64	0.54	
9/24/01	96.9	8.41	6.34	23.00	0.15	57	NR	Raining, NO3 probe failed
10/10/01	94.8	8.02	6.58	24.90	0.24	8	NR	
10/23/01	70.8	6.38	6.42	20.32	0.14	76	0.03	
Oswichee Creek								
7/25/01	94.3	7.86	5.35	24.50	0.37	20	NR	
8/10/01	84.2	7.09	5.74	24.30	0.58	19	NR	
8/24/01	92.4	7.79	5.04	23.20	0.54	17	NR	
9/10/01	92.5	7.81	3.92	23.78	0.72	17	0.06	
9/24/01	92.1	8.21	4.13	21.50	0.70	18	NR	Raining, NO3 probe failed
10/10/01	85.4	8.37	4.23	16.40	0.78	15	0.00	
10/23/01	85.4	8.48	4.36	16.01	0.87	18	0.00	
Sally Branch Creek								
7/25/01	90.9	7.51	5.15	25.00	0.29	18	NR	
8/10/01	89.9	7.55	4.25	25.20	0.46	17	NR	
8/24/01	88.5	7.52	4.60	23.10	0.46	14	NR	
9/10/01	87.0	7.32	3.45	23.90	0.52	16	0.04	
9/24/01	85.5	7.38	3.78	22.60	0.60	20	NR	Raining, NO3 probe failed
10/10/01	78.5	7.74	4.04	16.10	0.58	17	0.00	
10/23/01	80.1	8.05	4.06	15.99	0.53	20	0.00	
(Continued)								
¹ NR = No Reading.								

Table 8 (Concluded)

Date	DO, %	DO, mg/L	pH	Water Temp deg C	Depth, m	Specific Conductivity μ Siemens/cm	NO3 mg/L	Comment
Upatoi Creek								
7/25/01	85.8	6.91	5.58	26.4	0.51	17	NR	
8/10/01	84.2	6.74	5.78	27.2	0.28	12	NR	
8/24/01	91.7	7.42	5.60	26.4	0.07	10	NR	
9/10/01	87.5	7.13	4.69	25.7	0.29	12	0.52	
9/24/01	86.8	7.38	4.84	23.0	0.48	12	NR	Raining, NO3 probe failed
10/10/01	90.9	8.49	4.98	18.8	0.34	52	0.12	
10/23/01	90.7	8.85	5.04	16.7	0.36	8	0.00	

4 Summary

Extensive environmental data sets have been collected over the period May 1999 to July 2001 at Fort Benning, GA, in support of the ECMI program. These data sets are available to project and Fort Benning personnel from the ECMI data repository at <http://206.166.205.173>. Data collection at all stations will continue into the future. Data presented in this report are summaries of the environmental data sets contained in the repository.

REPORT DOCUMENTATION PAGE

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14. ABSTRACT The Department of Defense, Strategic Environmental Research and Development Program, Ecosystem Management Project, Ecosystem Characterization and Monitoring Initiative Program at Fort Benning, Georgia, is a long-term research program to characterize and monitor the environmental conditions and changes at Fort Benning and in the surrounding ecosystem. In an effort to fully complete the initiative, the U.S. Army Engineer Research and Development Center, Environmental Laboratory (EL), is collecting meteorological, stream, and groundwater data at selected sites at Fort Benning, Georgia. These include ten automated meteorological weather stations, six automated surface water stations, and four automated groundwater stations. This report describes the sensors deployed and the data collected in the first 27 months (May 1999 - July 2001).					
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Automated environmental data collection

Bonham Creek

Environmental data

ECMI

Fort Benning

Hydrological data

Little Pine Knot Creek

Meteorological data

Oswichee Creek

Randall Creek

Sally Branch Creek

SEMP

SERDP

Stream data

Upatoi Creek

Water quality data